Chemical Age

Progress at Union Carbide Polythene Plant
(page 767)

VOL. 82 No. 2107

28 November 1959

THE WEEKLY NEWSPAPER OF THE CHEMICAL INDUSTRY


TO EITHER TYPE OF ETHYLENE PLANT
RECOVERY PLANT
PYROLYSIS PLANT

INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age Directory & Who's Who**, *the second to the current issue*

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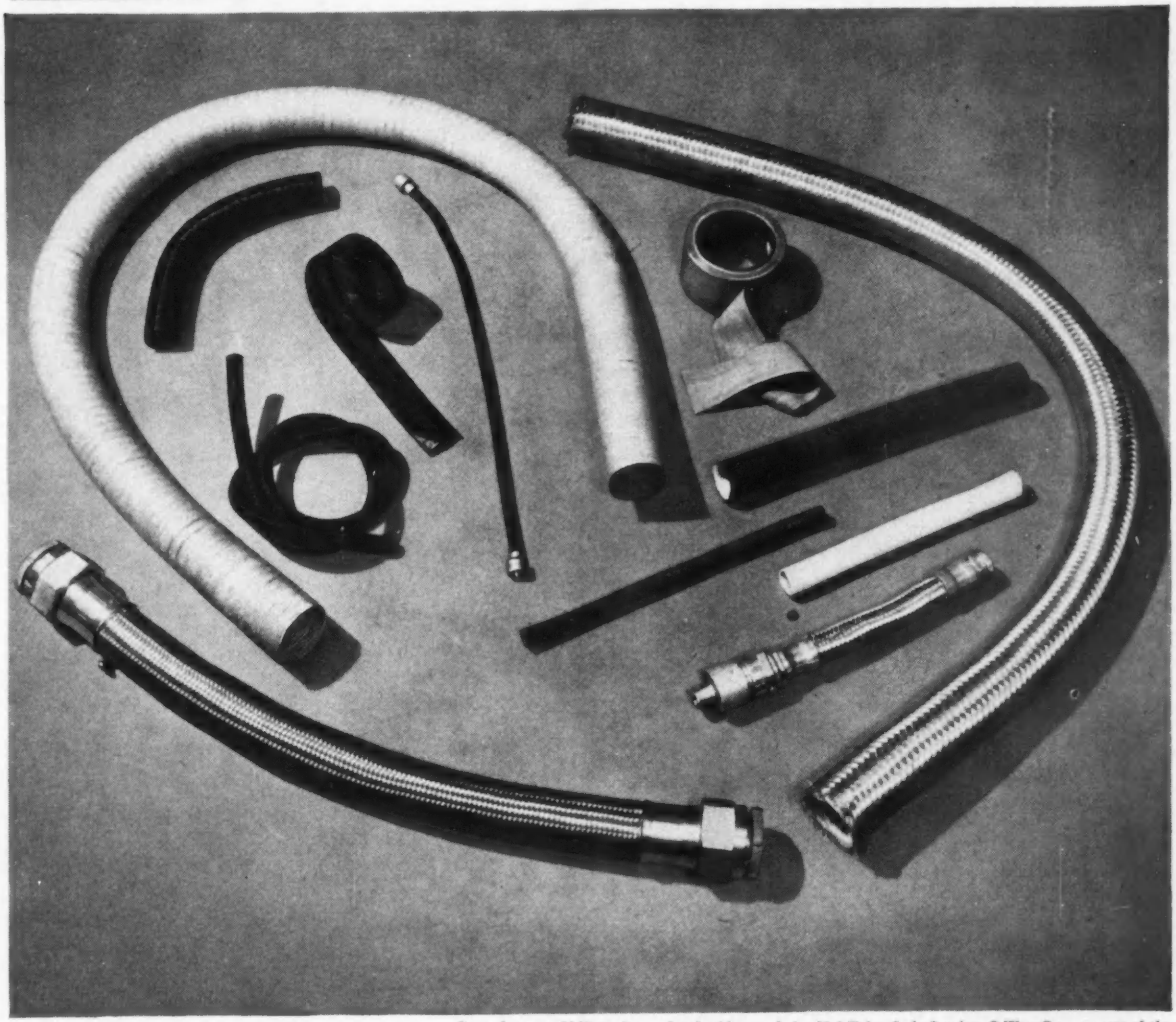
'FLUON' INCREASES PRODUCTION IN THE CHEMICAL INDUSTRY



Several types of 'Kopex' convoluted tubing made by Uni-Tubes Ltd., London, S.W.1. One or more of the component layers of the tubing are made from either 'Fluon' tape or 'Fluon' impregnated Fibreglass tape.

Why 'Fluon' was chosen in the manufacture of 'Kopex' convoluted tubing

ONE of the many types of 'Kopex' convoluted tubing made by Uni-Tubes Limited has to be corrosion and abrasion resistant. It must not be affected either by high or low temperatures. It must have a low coefficient of friction so as to facilitate threading with cables.

To ensure that it offers all these advantages, the manufacturers have used 'Fluon' tape or Fibreglass tape impregnated with 'Fluon' for one or more of the component layers of tubing. This tubing is used, among other things, to protect electrical harness in aircraft against de-icing fluids. It is also used as electrical cable conduit; hose for carrying non-inflammable hydraulic fluids, high temperature lubricating oils and most other corrosive fluids; for steam, missile fuel, and oxygen lines.

'Fluon' which is a tough, flexible material, has a remarkable range of properties:— a working temperature range from +250°C. down to at least liquid nitrogen temperatures; resistance to virtually all forms of chemical attack; the lowest coefficients of friction of any solid; and the best dielectric properties.

'FLUON'

'Fluon' is the registered trade mark for the polytetrafluoroethylene manufactured by I.C.I.

ICI IMPERIAL CHEMICAL INDUSTRIES LIMITED • LONDON S.W.1

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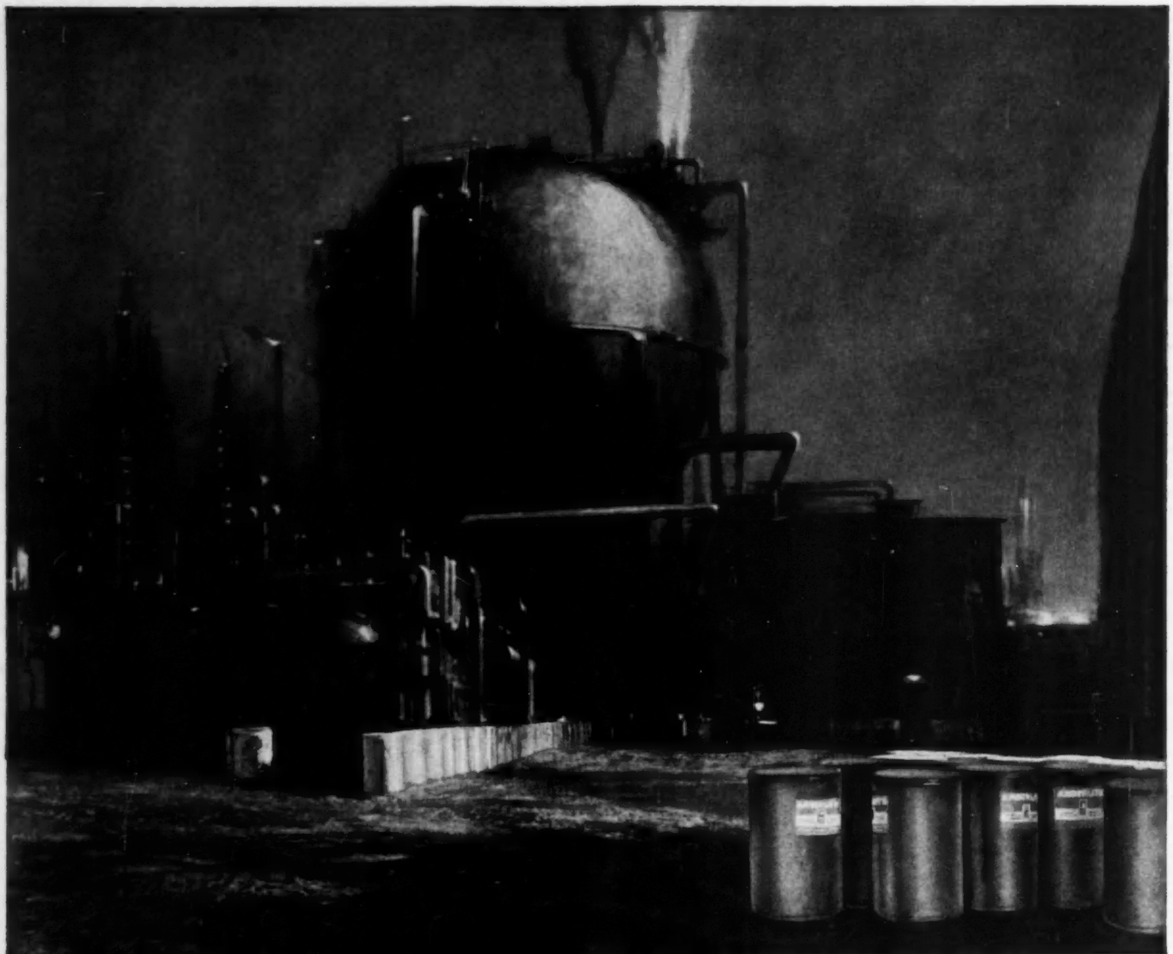

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CHEMICAL AGE

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IN THIS ISSUE

Annual subscription is: home, 52s 6d, overseas, 60s, single copies 1s 6d (by post 1s 9d)

POLICY FOR PROGRESS

WITH 'Policy for Progress' the third book in the series of reports written for the Science and Industry Committee, Professors C. F. Carter and B. R. Williams have completed the greater part of their work on the terms of reference of the committee which was set up by the British Association for the Advancement of Science in 1952. These terms of reference had two parts: analysis of what determines the speed of application of new scientific and technical knowledge in British industry; and the making of proposals for increasing that speed of application.

The broad conclusion of Carter and Williams' analysis was reported in 1957 in *Industry and Technical Progress* and some conclusions on the special question of decisions to spend money on capital equipment in *Investment in Innovation* in 1958. In this latest book, published this week, by making proposals for action, the authors round off the analysis. Suggestions are made for policy and action, by industry and by Government, which may assist in the fruitful application of science.

The first part of the book is devoted to action by industry and contains ideas for management, in small firms as well as in large, on such matters as the communication of scientific knowledge, the use and conduct of research and development, and the finance of innovation. In the second part the action by Government is examined from the point of view whereby Government can make it easier for industry to progress in its techniques—that is, by support of research and by appropriate policies for education, taxation, credit, foreign trade, and the control of restrictive practices.

Setting out as they do to write on so general a subject matter, it is inevitable that some of the proposals Carter and Williams make will seem to some to be elementary and obvious. The authors themselves admit this, but in so many instances the obvious is not practised, and there is so much more valuable advice given and proposals made that this third book must be deemed an essential guide to industrialists, academicians and politicians alike.

Obviously in a limited space, justice cannot be done to *Policy for Progress*. Some few points can be examined, however. In the section on action by industry, much attention has been paid to speeding-up opportunities for technical progress in firms. Under general rules, work study, production planning and control, budgetary control, improved costing and market research are techniques requiring attention and use of consultants may be advantageous, it is suggested.

Market research, Carter and Williams have noted to be "rudimentary or non-existent" with firms having a 'take it or leave it attitude' often associated with technical backwardness. Firms conscious of a need for technical progress could find consultants to advise on the introduction of new management techniques and also on the absorption into the firm of established technological practices (see p. 770). It is still evident that it is the large firms which already possess research departments which make the greater use of the research associations.

Contacts with universities and technical colleges could be better—a point that this journal has suggested more than once. Also it seems that British

industry employs far more of its scientists and engineers within specialist departments than U.S. industry; concentration that is "sometimes a source of weakness."

Companies who complain that they could do more if they had more capital receive little sympathy from Carter and Williams. Failure to know costs or to do costing properly can mislead firms in production or investment policy, they report. Excessive variety may hold up desirable changes of method, while firms claiming to be short of money often fail to take the trouble to find out sources from which they might get it. Some useful advice in raising capital is given while in the second part of the book a list of institutions of the capital market is included.

At a time when advertisements for scientific posts are numerous, the chapter on recruitment and training is timely. A 10-year plan for recruitment, revised at intervals is recommended as good practice. It should not assume excessive recruitment from outside the firm for senior posts. Family firms are warned to be conscious of the special dangers of their form of organisation; members of the family should be chosen for managerial position on merit and special attention given to obtaining technical training and outside experience for them. Varied channels of recruitment at different ages are stressed. Some plain speaking is done here but is timely.

When this book was written the Government had no Minister for Science, but the points raised by Carter and Williams in Part Two, 'Action for Government', will no doubt be closely studied by Lord Hailsham, now appointed Minister for Science. Quite bluntly, the authors say "we doubt if it can be said that a Government policy on the application of science really exists. The facts on which such a policy should be based have never been collected or assessed." Substantial research by a group containing both scientists and economists is indicated and in its absence, it is suggested, "policy-making tends to go no further than a statement of generalities."

Technical and scientific education is considered and a number of proposals made. Technical training, it is suggested, is falling behind the training of technologists and scientists. Tax remissions for apprenticeship schemes or even a compulsory levy for a scheme of "industry apprenticeship" might produce the needed rapid expansion in the intake of apprentices. The universities, Carter and Williams feel, should take a greater interest in finding the best form of education for future managers.

Effects of a number of possible changes in the taxation system are discussed. A lowering and equalisation of taxes on expenditure, and a reduction in surtax rates, would be likely to favour technical progress, it is believed. Of particular appeal is the suggestion that special investment allowances for development costs should be considered. Also, thought should be given to the creation of the equivalent of the American 'Small Business Administration' which makes long-term loans at favourable rates of interest.

In a chapter on 'protection against foreign competition' the conclusion is that there is no general principle that protection favours (or retards) technical progress; each industry demands separate consideration (which does not appear to be given at present). Also, in the Treasury and Board of Trade applying the Import Duties Act of 1958, it is not clear that the necessary machinery for research into the desirability of maintaining and promoting efficiency of production in the U.K. exists. Carter and Williams are not sure either if abolition of independent review by the Import Duties Advisory Committee was wise.

The effect on technical progress of restrictive practices by both management and labour is not forgotten either. The authors propose that the Minister of Labour should be empowered to refer to a Commission of Inquiry the general state of labour relations in an industry where it appears they are such as to endanger efficiency, technical progress, or the competitiveness of British goods in export markets. The committee would make investigations like those of the Monopolies Commission and publish a report and recommendations. Obviously the trade unions would not be in favour, but the public would.

Policy for Progress offers therefore advice to firms unsure about research expenditure, discusses frictions that can arise between production staff and scientists in a company, considers education, proposes sensible tax reductions, indicates the ways of making long-term loans to industry, expresses some views on protection against foreign competition and proposes Commissions of Inquiry to investigate bad labour relations in industries.

CHEMICALS AND 'OUTER SEVEN'

THE initialling of the 'outer seven' agreement last weekend with the Governments of Austria, Denmark, Norway, Portugal, Sweden and Switzerland will not have any great impact on British chemical exports, either in the near or far future. The first reduction in tariffs—a cut of 20%—will be of more benefit to 'outer seven' exporters to this country.

For Austria, Norway, Portugal, Sweden and Switzerland it will mean reducing an already low tariff of 5% to 4%; for the U.K. it will mean a reduction of from 33⅓% to 26⅔%. The British chemical industry has already given its support to the new free trade association in the hope that it will eventually lead to closer ties with the European Common Market.

Of the U.K. chemical export total for January to October this year (a record figure of £240.2 million) shipments to the 'outer seven' were valued at £22.5 million (£19.9 million in the first 10 months last year). Chemical imports from the area totalled £12.7 million for the same period (£10.8 million for January-October 1958).

Chemical trade with the Common Market countries was, by comparison far more valuable, but instead of a favourable balance of £9.8 million, there was an adverse balance of £7.7 million. U.K. exports of chemicals to the C.M. in the first 10 months of 1959 were valued at £38.3 million (against £34.8 million); imports from the C.M. were worth £45 million (£39.7 million for 1958).

U.K. EXPORTS OF CHEMICALS
(In £ million)

	1958	Jan.-Oct. 1958	Jan.-Oct. 1959
'Outer Seven'			
Austria	1.02	0.86	1.05
Denmark	5.17	4.22	4.48
Norway	4.64	3.78	4.22
Portugal	2.83	2.43	2.49
Sweden	7.62	6.10	7.30
Switzerland	3.07	2.51	2.98
	24.35	19.90	22.52
'Common Market'			
Belgium	6.21	5.13	5.80
France	7.66	6.39	5.92
Germany, West	10.46	8.66	8.89
Holland	9.94	8.31	9.92
Italy	7.72	6.33	7.83
	41.99	34.82	38.36

U.K. IMPORTS OF CHEMICALS
(In £ million)

	1958	Jan.-Oct. 1958	Jan.Oct. 1959
'Outer Seven' *			
Denmark	0.60	0.51	0.53
Norway	3.50	2.94	3.36
Portugal	1.09	0.85	1,28
Sweden	2.86	2.37	2.43
Switzerland	5.13	4.13	5.17
	13.18	10.80	12.77
'Common Market'			
Belgium	4.16	3.49	4.31
France	10.94	9.34	10.22
Germany, West	21.38	17.71	19.25
Holland	8.46	6.68	8.04
Italy	2.91	2.50	3.25
	47.85	39.72	45.07

* Not including Austria.

Dow Broaden U.K. Activities and Set-up German Subsidiary

WITH ITS change of name to Dow Chemical Co. (U.K.) Ltd., the British subsidiary of the Michigan U.S. firm, formerly known as Dobeckmun Britain Ltd., has broadened the scope of its activities.

The company will continue to handle the manufacture and sale of Lurex, a non-tarnishing metallic yarn, produced in Windsor, Berks. In addition, it will take over direct sales of Dow-produced packaging films such as Trycite (Dow polystyrene film), Saran Wrap (Dow vinylvinylidene chloride copolymer film), and polythene film. It will also supervise the sales of Dow U.S. and Canadian-produced industrial chemicals, plastics and magnesium in the U.K.

In the latter line of products, the company will continue to use the services of appointed distributors. R. W. Greeff and Co. Ltd. will continue as principal distributor handling chemicals, coatings raw materials and magnesium. British Resin Products Ltd. are the distributors for certain plastics moulding materials; W. J. Fraser and Co. Ltd. for Dowtherm, a heat exchange system; and Union Glue and Gelatin Co. for Dowicide industrial preservatives.

Mr. Robert H. Gregory will remain the managing director and a board member of the British company. He is a founder member of the Packaging Institute, and prior to his association with Dow was managing director of the Liverpool packaging specialists, Brown, Bibby and Gregory Ltd. In addition to the above company, Dow interests in Britain include 74% control of Dow Agrochemicals Ltd., manufacturers of agricultural chemical products, and 45% participation in Distrene Ltd., manufacturers of polystyrene plastics. Address of the company is Dow Chemical Co. (U.K.) Ltd., 48 Charles Street, London W.1.

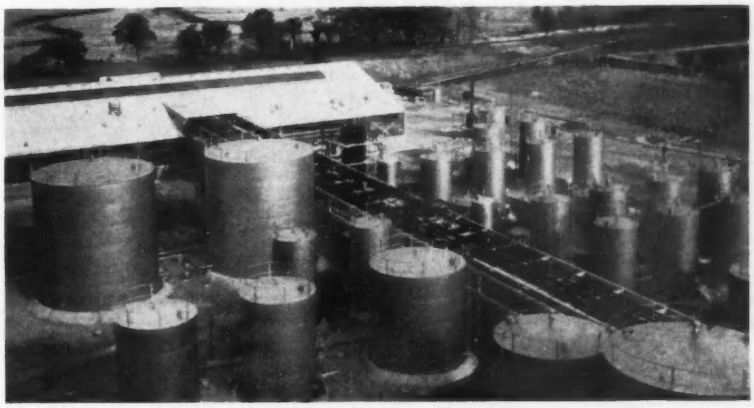
The Dow Chemical Co., of New York, has set up a subsidiary in West Germany with a nominal capital of £430,000. Dow's European operations have hitherto been in the hands of a subsidiary in Switzerland.

The new venture in Germany gives the concern a foothold within the Common Market. Dow already have business links with Badische Anilin (B.A.S.F.), one of the leading German chemical companies. In 1958 they jointly founded a company, Dow-Badische, to produce acetylene derivatives at Freeport, Texas.

U.K. Chemical Exports Rise 16%

An increase of 16% in U.K. exports of chemicals was recorded in the period January to October 1959, when total shipments were valued at £240,238,152 (£216,296,193 in 1958). The October figure of £26,522,426 compares with an October 1958 total of £22,053,764 and a January to September 1959 monthly average of £23,747,000.

UNION CARBIDE PLANT NEARS COMPLETION AT HYTHE



Work on the £3 million Union Carbide petrochemicals plant at Hythe is reported well up to schedule and is due for completion before the year-end. Ethylene supplied by the adjacent Esso refinery will be converted into ethylene oxide derivatives to provide a yearly output of some 45 million lb. of petrochemicals

CONSIDERABLE emphasis on automation is incorporated in design of the Union Carbide petrochemicals plant at Hythe, near Southampton, where ethylene from the adjacent Esso plant will be converted into ethylene oxide derivatives to provide annual output of about 45 million lb. of petrochemicals. Built by Geo. Wimpey and Co. Ltd. to plans by Union Carbide's design team, the installations include units for the production of ethylene oxide, ethylene glycols, polyethylene glycols, ethanolamines, glycol ethers and specialised products including polyglycol ethers, polyglycol esters, and other surfactants.

The Hythe plant, due for completion before the end of the year, is the second major petrochemicals producing plant of Union Carbide in the U.K., and capacity of the polythene plant at Grangemouth, which has been operating for about two years, is to be doubled. The firm manufacture a variety of other industrial products in this country, including ferro-alloys and electro metallurgical products (Alloys Division), and barium getters (Kemet Division). An affiliate of the company, British Acheson Electrodes Ltd., is a major producer of carbon and graphite electrodes, Karbate impervious graphite, and specially pure graphite for the A.E.A. Another affiliate, Bakelite Ltd. (who distribute Union Carbide polythene) are, of course, widely known as manufacturers of plastics materials.

Microcal for Resins and Rubber

IN order to expand the basis of their standard compounding data, Joseph Crosfield and Sons, Ltd., Warrington, Lancs, have prepared a series of natural rubber/50% styrene resin compoundings in which the properties of the vulcanisates have been varied while keeping the rest of the formula similar to the Crosfield standard resin-rubber compound. In *Progress Report No. 4* details are given of the use of Microcal 160 and 210 (calcium silicates) in resin rubber compounds.

Microcal 210 is stated to be useful in compounds of high resin content on account of its good set properties. In other compounds of lower resin content, Microcal 210 is stated to generally produce a lower tear strength than Microcal 160. At a given proportion of high styrene resin to natural rubber, increasing loadings of the Microcals in the rubber compounds produce progressively harder, stiffer materials with some loss of tensile strength and elongation. There is evidence to show that by judicious use of calcium silicates, less resin may be used to impart certain desired property levels, thus achieving, it is claimed, economies with the advantage of having, in general, superior permanent set values.

In *Progress Report No. 3*, the work carried out and described in report No. 4 has been extended to include lower loadings of Microcal in the natural rubber compounds. Both Microcals are easily incorporated, it is stated, into natural rubber compounds in loadings from 20 to 90 weights of Microcal per 100 weights of rubber. Microcal 210 generally imparts lower tensile and wear strengths than Microcal 160 at the same loading level, it is reported, and while the elongation at breaks of Microcal 160, somewhat below that of Microcal 160, Microcal 210 imparts a slightly higher hardness than Microcal 160 in corresponding compounds.

★ Two new major construction projects in the U.K. are posing an interesting question. Who will be first on stream with the first British polypropylene production—I.C.I. or Shell Chemical? I.C.I.'s plant at Wilton would seem to have a lead at present with structural steelwork completed.

As I disclosed exclusively earlier this year Constructors John Brown are main contractors for the I.C.I. project, although the news has yet to be made 'official.' Now I can reveal that Matthew Hall are main contractors for the Shell polypropylene plant, for which construction has started at Carrington, near Manchester. Shell themselves are handling design and procurement.

Shell's on-stream time has been scheduled as 1961. Their capacity is 30,000 tons a year of olefins (L.P. Ziegler polythene and polypropylene, using a Shell process based on Natta and Ziegler work). I.C.I. have given no capacity and no on-stream time, and although they are ahead on construction so far it might well be that their plant is much larger and may not start operating until after Shell. I.C.I. capacity is suggested as upwards of 10,000 tons a year.

★ RELATING chemistry learned at school to the same chemistry as applied in industrial practice is a problem familiar to all teachers and students. So to bridge the gap Imperial Chemical Industries have decided to sponsor the publication of a number of textbooks. The company have had the advice and assistance of the Science Masters' Association and the Association of Women Science Teachers in the preparation of these books. Just published by the Oxford University Press are *Ammonia: Manufacture and Uses,* by A. J. Harding (price 6s 6d) and *Electrolytic Manufacture of Chemicals from Salts,* by D. W. F. Hardie (price 7s 6d).

Dr. Harding is exploratory group manager in Billingham Division's research department, and this is Dr. Harding's first textbook, prepared when he was in the Billingham technical department. Dr. Hardie, of General Chemicals Division, is a notable chemical industry historian, having written the 'Chemical Pioneers' series for this journal and contributed to *Endeavour* and other journals.

The two books are not an I.C.I. 'free issue' and apart from sending complimentary copies to senior science teachers in secondary, grammar and public schools, they are a commercial venture and will be sold in the normal way.

Both books make interesting reading for all chemists not closely associated with these processes, and they will undoubtedly prove of the highest value to senior pupils in schools and junior students in technical colleges and universities.

★ DOCTORS, biologists, biochemists and 'synthetic' chemists from all parts of the U.S. met in Washington on 11 and 12 November to report progress made in the treatment of cancer, using drugs. Surgery and X-ray still represent the best method of attacking the disease but comparatively recently considerable progress has been made using chemical agents, such as those derived from nitrogen mustard, also certain antibiotics and hormones.

The hypothesis on which this work is based is that in cancer cells, as in bacteria, specific essential biochemical processes may be interrupted by the drug, thereby bringing about the cell's destruction. One outstanding problem inherent to this approach is that of discovering a biochemical process in the cancer cell which is not common to that of the normal cells around it. Unfortunately all of the currently available drugs tend to destroy some the patient's healthy cells.

Papers read at the meeting described the results of clinical studies in which presently available drugs have been used alone or in conjunction with surgery for the alleviation and treatment of malignant disease. Other contributors discussed the relationship between the chemical structure of the drugs and their anti-cancer activity, a proper understanding of which, it is hoped, will lead ultimately to the discovery of many potent anti-cancer drugs.

★ IT SEEMS that Soviet scientists are as far advanced in some areas of research on nerve gases—or G-agents as they are known—as U.S. workers and in some cases are further ahead. This was said at Wisconsin University recently by Dr. B. J. Jandor, chief of the Biochemical Research Division at the U.S. Army Chemical Warfare Laboratory, Maryland. He added that a good deal of work in the study of organic phosphate compounds in systemic insecticides has been done in Wisconsin; Russia had been in the field longer than the West.

Although the U.S. would never use gas unless her enemies started a chemical war, Dr. Jandorf said that scientists were finding new antidotes, notably a combination of atropine and the cheaper oximes. Animals treated with this were able to withstand 50 to 80 normal lethal doses of the nerve gases.

He pointed out that these gases are not gases at all, but are usually liquids used in vapour form, their discovery stemming from a study of organic phosphate compounds. They are called G-agents because the compounds originated in Germany, where Schrader was working on insecticides. By 1945, the Germans had two full-scale plants, one was captured by the Allies, the other by the Russians.

★ SCIENTIFIC and local authorities in Kiel, are in fact, faced with the problem of disposing safely of three sunken barges laden with some 80,000 chemical shells containing what is described as a highly-effective nerve gas. One milligram is said to be sufficient to paralyse the nervous system and to prove lethal. The barges lie on the bed of the Bay of Flensburg and the outer bay of Kiel.

An old freighter is to be rebuilt to transport the shells which must first be brought up individually by divers. Working 30 metres under the surface they will have the unenviable task of packing the shells in containers which will be hauled aboard the vessel, where each shell is to be fitted with a protecting cap. The shells will then be packed in iron drums that will be sealed in concrete.

This deadly cargo will be transported to the North Sea where the drums will be deposited on the sea bed.

★ BY 1960 over two-thirds of the world's rubber markets will be held by the synthetic product, while its share of the U.S. market will be even greater. This is the view of Mr. George Villa, United States Rubber, who said last week that natural rubber was costly to produce and that the low replanting rate in Indonesia doomed it to a steady decline.

In Munster, Professor Dr. Baumann, chairman of Chemische Werke Hüls, AG, declared that by 1965 total world consumption would probably be about 4.3 million tonnes, against 3 million in 1956. Some 2.3 million of that 1965 figure would probably be in synthetic rubber; in the U.S. between 70% and 75% of all rubber used would be synthetic.

He put West Germany's total rubber consumption for the coming year at some 200,000 tonnes, of which 37½% would be synthetic. Of the synthetic total of 75,000 tonnes, all but 10,000 tonnes, will come from the year-old Bunawerke Hüls GmbH. Expansion plans at Bunawerke involve a further spending of DM.7 million (£583,500); capacity of the polymerisation units has been increased to some 100,000 tonnes and there is enough butadiene and styrene on hand to permit production to be raised by some 40,000 tonnes. New plants to carry this expansion should come on stream in May or June next.

Alembic

De Beers have Synthetic Diamond Process

A PROCESS for making synthetic industrial diamonds of the same type as those manufactured by U.S. General Electric Co. (see CHEMICAL AGE, 21 November, p. 740) was announced last week by Mr. H. F. Oppenheimer, chairman of De Beers Consolidated Mines. Applications for a patent of the process developed in the company's Adament Laboratory, Johannesburg (set up in 1956), have been filed by De Beers throughout the world.

The De Beers process, which first produced 0.4 millimetre by 0.25 millimetre man-made stones in September 1958, resembles the G.E. process in using a combination of very high pressures and temperatures. It is still in the laboratory stage but the company believe that it would be economically possible to proceed to manufacture on a commercial scale if it was found desirable to do so. The diamonds made in the De Beers laboratory are of the abrasive grit type suitable for use in resin-bonded grinding wheels.

Dr. J. F. H. Custers, director of research, reports that the most recent De Beers experiments have indicated that their process can be used to produce "different types of material".

Other countries working on synthetic diamond manufacture, include Russia, Sweden, Holland, France and Germany. Dutch companies include Asscher's Diamontnijrerheid N.V., Bronswerk and N.V. Philips of Eindhoven. The Asscher technique is known to involve the use of explosives to provide the required pressures and temperatures.

Production of 'Courtelle' Acrylic Fibre to be Doubled

COURTAULDS LTD. have decided to double capacity at their Grimsby factory for their new acrylic fibre, 'Courtelle'. The price of standard 'Courtelle' in 3, 4½ and 6 denier will be reduced from 100d to 96d per lb., while a special quality will be offered in coarse deniers at 78d per lb.

Present annual capacity of this factory, which came into operation in March this year, is 10 million lb. In addition the plant at Little Heath Works, Coventry, which started production in 1957, has capacity for 2 million lb.

It is stated that the extension can easily be accommodated on the 500-acre site, where rayon staple as well as acrylic fibre is produced. Work is already in hand and the new plant is scheduled to come into production early in 1961.

QVF at the Building Exhibition

A full-scale laboratory complete in every detail has formed the basis of the stand of QVF Ltd., chemical engineers in glass, Stoke-on-Trent, Staffs, at the building exhibition being held in London from 18 November to 2 December. The laboratory illustrates advantages of the system of glass sink traps and wastelines which have provided an efficient answer to disposal problems of noxious liquids in laboratories.

Better Processability Claimed for Monsanto Polythene

ONE of the outstanding characteristics of the polythene grades now being made by Monsanto Chemicals Ltd. at their new Fawley factory which came into operation earlier this year is the improved processability which is claimed to enable output to be increased by as much as 10% in some cases. This is due to the special flow properties of the polymer and to the small pellet size (3/32 in.) in which the material is supplied.

Monsanto have now issued details of a number of their polythene grades and they state that films for all purposes can be extruded from the five film grades available. M.303 is a compound producing a high clarity film for display packaging of textiles, nylons, etc. with a clarity said to be as high as any other and with the advantage of being stronger. M.401, a slip grade film compound, combines strength and high clarity for produce pre-packaging and display packaging of toys, etc.

Other film grades are M.301, for use in industrial bags and drum liners, agricultural film, tarpaulins, and moisture barriers for concrete underlays; M.302, based on M.301, contains 2-3% of a high-grade channel black and 0.2–0.3% of an antioxidant, and is suitable for outdoor use where good physical properties must be retained over long periods, i.e., for mulching film, irrigation tubing and silo covers. M.402 is a resin containing no slip additive and is the base polymer from which M.401 is formulated. It is recommended for extrusion laminates or blending to reduce slip level in certain special cases.

Five types of polythene for injection moulding are being produced by Monsanto. In addition to excellent processability, the small pellet size is an aid in the dry colouring of the material and provides optimum colour dispersion. Mouldings are said to be relatively free from stresses and strains and have improved resistance to environmental stress cracking.

The injection moulding grades are: M.301, a low melt index (2) material with exceptional toughness and high resistance to environmental stress cracking; M.501, a general purpose material of intermediate melt index (7), which combines easy processability with good physical properties and surface finish; M.801, a high melt index (20) material is suitable for high-speed moulding and giving a superior surface finish; M.802 with the same melt index but higher density (0.921, compared with 0.916) gives a fast flowing resin suitable for articles of increased rigidity and gloss. M.803 has similar properties but contains a slip additive to overcome problems of bowls, buckets, etc., sticking together when stacked.

Further grades including cable and pipe compounds are also being manufactured at Fawley.

Novel Features in I.C.I. Ardeer Nitroglycerine Plant

A NEW nitroglycerine plant erected by the division engineering construction section is now operating with many novel features at the Ardeer works of the I.C.I. Nobel Division. Known as the N.A.B. plant, it was evolved in the Gyttorp factory of Nitroglycerine Aktiebolaget, Sweden, founded by Nobel in 1864 and the world's oldest producer of nitroglycerine.

When in full operation the new N.A.B. plant will have greater hourly output than existing units at Ardeer. Division technical staff visited the Gyttorp factory several times and collaborated with the Swedish firm in design and development. Swedish representatives co-operated during commissioning and when process men have been trained and smooth running established, the plant will be handed over to Ardeer works.

Features of the N.A.B. system of injection nitration coupled with centrifugal separation are simplicity and great safety. In the process the flow of nitrating acid through the injector sucks in the right amount of glycerine mixed with air. This injector system in which the vital reaction takes place is small enough to be carried in the hand. Transformation of glycerine to nitroglycerine takes less than a second and the product immediately forms an emulsion with spent acid. In that form the product is safe.

After cooling, the nitroglycerine is separated from the mixed acid in a centrifuge, a process occupying about 30 seconds. The nitroglycerine is then washed free from all trace of acid.

With this combination of equipment, the total amount of nitroglycerine in process during nitration and separation is said to be only one-tenth part of the quantity in other continuous systems. There is no moving machinery or free nitroglycerine in the nitrating house. Two centrifugal separators are housed in small over-mounded concrete blockhouses neither of which holds more than 15 lb. of nitroglycerine at any time when the plant is in full production.

Nitration and separation are controlled from a panel fixed to a thick reinforced concrete wall placed between the operator and the nitrating system. Start-up or shut-down can be controlled in a few minutes.

Washing is carried out by a column system also designed by the Swedish company; it is said that work in hand by the division's research department should yield a washing method that will match the simplicity and inherent safety of the nitration and separation stages.

In Parliament

Panel of Scientists to Investigate Research on Toxic Sprays

USE of toxic sprays in agriculture was the subject of questions in both Lords and Commons last week. In the House of Lords, Lord Ailwyn, while appreciating the fact that Fisons had withdrawn all stocks and stopped distribution of their arsenical weedkillers, asked if it was not a fact that a far more serious and dangerous compound was the organo-phosphorus insecticide, which was toxic to mammals and birds, not only when eaten, but also when absorbed through skin and eyes? He wanted to know what action, if any, had been taken to prohibit forthwith the supply and distribution of that "lethal product".

Earl Waldegrave, Parliamentary Secretary to the Ministry of Agriculture, said the Minister was giving the matter his most urgent attention. In relation to arsenical sprays, he hoped to make a statement very shortly. They had to keep a sense of proportion; there were risks, but they must not lose sight of the fact that the advantages of using chemicals in agriculture were also very great.

Replying to a Commons debate on toxic sprays, Mr. J. B. Godber, Parliamentary Secretary to the Ministry, also said that chemical sprays played a most valuable part in agricultural production. Research was yielding results and several poisonous chemicals had been replaced by safe and effective insecticides and weedkillers.

Advisory Committee

The Government was considering adding to the Advisory Committee on Poisonous Substances Used in Agriculture by appointing eminent independent members in the fields of medicine, agriculture, chemistry and nature conservancy. The Minister, with the Ministers of Science and Health, had decided to arrange for a small group of scientists to review the situation and to make proposals as to whether more research was necessary.

The Minister's consultations on the recommendations of the Advisory Committee had now reached an advanced state and within the last week he had discussed the matter with representatives of the Association of British Chemical Manufacturers, Association of British Manufacturers of Agricultural Chemicals, Association of British Sheep and Cattle Dip Manufacturers, National Association of Corn and Agricultural Merchants, National Farmers' Union, National Association of Agricultural Contractors and the British Chemical Dyestuffs and Traders' Association (Importers).

In a written answer, the Minister of Health had stated that there had been no substantial evidence that current methods of using agricultural sprays containing cumulative poisons in this country were likely to produce serious chronic effects on health, but the situation was under review.

Answering a series of Parliamentary questions, Mr. Godber said the Minister of Agriculture had no statutory powers to ban the use of arsenical weedkillers in agriculture. The Minister's current review included the possible pollution of reservoirs as a result of spraying.

Speaking on behalf of the Minister of Science, Mr. Godber then stated that three units of the Medical Research Council were engaged on research into the effects on human health, both acute and cumulative, of chemicals used in agriculture. The effect on animals and plants was the subject of research at Agricultural Research Council stations, while research into the effect on wild life had been planned by the Nature Conservancy. Those studies were closely interconnected; research was also being carried out by the manufacturers.

Control of Royal Ordnance and Research Establishments

The following is a complete list of establishments of the former Ministry of Supply which now fall within the responsibility of the Ministry of Aviation: Royal Ordnance Factory, Burghfield; Royal Ordnance Factory, Cardiff; Royal Aircraft Establishment, Farnborough (and its outstations); Royal Radar Establishment, Malvern and Pershore; Aeroplane and Armament Experimental Establishment, Boscombe Down; Tropical Experimental Unit, Idris, Libya; Aircraft Torpedo Development Unit, Helston; National Gas Turbine Establishment, Pyestock; Empire Test Pilots' School, Farnborough; Rocket Propulsion Establishment, Westcott; Signals Research and Development Establishment, Christchurch; Explosives Research and Development Establishment, Waltham Abbey and Woolwich.

Pyrethrum Development

In response to a question about work in hand to increase yields of pyrethrum in Kenya, and to "develop new markets for this insecticide". The Secretary of State for the Colonies reminded the questioner about the research station operated by the Kenya Government, and the existence of the Kenya Pyrethrum Board's research laboratory. The written reply to the question also referred to the European centre in London, maintained by the African Pyrethrum Technical Information Centre, which is "engaged in development of new users and markets for pyrethrum-based insecticides".

"U.K. Industry Does Not Make Enough Use of Consulting Scientists"

THE use that British industry makes of consulting scientists and contract research was criticised at a meeting held in London last week by the newly formed Association of Consulting Scientists. It was felt that British industry's interest in independent consulting and research services was often confined to *ad hoc* problems, such as 'trouble-shooting' and that little interest was shown in fostering new results by long-term research assignments.

It was also felt that many of the larger British companies placed their contract research with overseas organisations rather than with U.K. companies. These views followed a talk entitled 'The creation of an image' by Mr. Hereward Phillips, chairman, Institute of Public Relations.

In the discussion period, members spoke of the need to publicise the services of the independent consultant and ways of achieving this. It was generally thought that an advertising campaign for the association would prove too costly, while some members felt they should be free to advertise their services individually and in a dignified way. In this connection there was some criticism of the ethical approach of the Royal Institute of Chemistry to the question of advertising on the part of consultants.

There was some complaint that British companies placed their contract research overseas and it was said that about 50 to 60% of the Battelle Institute's work in Geneva was for British firms. For the Sondes Place Research Laboratories it was stated that some 95% of their work was for large companies. At the Fulmer Research Institute the "work we get from British industry does not amount to very much, some of it coming from small firms" who did not have their own facilities. Most of their work came from Government Departments or state organisations, like the Atomic Energy Authority.

It was said to be much more difficult to interest British firms in research than to interest the large foreign firm. One member asked "Why does U.K. industry let all its best brains be used by American industry?"

The Association of Consulting Scientists now has 47 member-firms of which 16 are interested in contract research.

British Celanese to Expand Polyolefin Yarn Production

BRITISH Celanese Ltd. will double production capacity at Coventry for their polythene and other polyolefin monofilament and multifilament yarns. The first stage of the expansion is due for completion before the end of this year and the new plant is scheduled for full production by the middle of 1960. The firm are reported to draw supplies of polypropylene from Montecatini and Shell Chemical, who are constructing a plant for its manufacture on a commercial scale (see 'Distillates', p. 768).

EQUIPMENT FOR DISTILLATION OF HEAT-SENSITIVE SUBSTANCES

EXHIBITED for the first time at the Physical Society's exhibition early this year, production models of Speedivac distillation equipment are now in service, and considerable experience in processing resins, esters and glycerine involving simple distillation, stripping of residual alcohols and separation of polyglycols and monoglycerides has reportedly been gained.

Distillation of heat-sensitive substances has always been a difficult problem, and by normal methods the process has only been achieved in the past under constant danger of thermal decomposition. Under vacuum, however, the boiling point of these substances is considerably reduced so that high vacuum distillation can be carried out with lower thermal hazards than any other method, it is claimed.

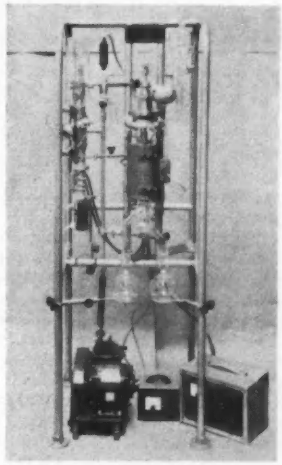
The 2 in. molecular still, shown at the exhibition, comprises a glass feed flask, evaporator with heating mantle, cold trap, collecting flask, all mounted in tubular steel framework with vacuum pumps and gauges. The rotary pump is mounted on the floor below the framework as are the vacuum gauge and heater control units, although for convenience these cabinets would normally be raised to bench height. (Other models are the 4 in. and 12 in. stills.)

The glass feed flask has a capacity of 500 ml. and is provided with a degassing tube which allows controlled degassing and stripping of low boiling contaminants before starting distillation. The evaporator consists of a glass column 2 in. in diameter, having a heated length of approximately 8 in. and total surface area of 50 square inches.

The incoming feed is exposed to the heated surface for approximately ten seconds, an average film thickness of between 0.01 and 0.005 in. being obtained, although this figure is dependent on viscosity of the crude feed. The stripped fractions pass up the evaporator body and condense into the cold trap, while low-boiling fractions which do evaporate condense on the water-cooled condenser inside the evaporator and drain into the distillate flask.

A finger-type cold trap is mounted above and in between the evaporator and oil diffusion pump. It can be charged with solid carbon dioxide and methylated spirits and the condensate can be removed from the trap by means of a valve.

The vacuum pumps provided with the 2 in. still are the Model 102 Speedivac oil diffusion pump, which is backed by a Model 2SC20 two-stage rotary pump. Further particulars from Edwards High Vacuum Ltd., Manor Royal, Crawley.



The Edwards High Vacuum Ltd. distillation equipment

Booklet on Chemical Engineering Courses

A NEW pamphlet published by The Institution of Chemical Engineers comprises a collection of information on scholarships, courses and apprenticeship training schemes in chemical engineering.

Designed primarily for the benefit of school boys and girls who have shown interest in a career in chemical engineering, the new pamphlet is supplementary to the more philosophical pamphlet 'Chemical Engineering: A Career'. It will also be of interest to many chemical engineers and others in industry who have a professional interest in matters relating to the education and training, and a copy will be sent free of charge to any person on written application to the institution, 16 Belgrave Square, London S.W.1.

Molecular Sieves Separate Oxygen from Argon

PRIMARY source of argon is air, and conventional air-separation plants are equipped to recover it. Crude argon taken from air-distillation columns, however, contains quite an amount of oxygen and some nitrogen which can be removed by further low temperature distillation. The oxygen, because of low relative volatility between it and the argon (1:1.2 ratio at high argon concentration), cannot be separated so easily. Normally the oxygen impurity is removed by chemical means—e.g., by burning it catalytically in an excess of hydrogen to form water which is commercially extracted by conventional dryers. The surplus hydrogen is then eliminated by subsequent distillation.

From Union Carbide's Linde Co., in the U.S. comes news of another way to remove residual oxygen from argon—adsorption by molecular sieves. Developed by Linde, the process is described in U.S. Patent 2,810,454. Molecular sieves—synthetic sodium aluminium silicates or zeolites—are made by Linde in various pore sizes, and can be 'tailored' to absorb molecules or atoms of definite dimensions from gases or liquids. For removal of oxygen, molecular sieve type 4A is suggested, since this has a pore size which admits atoms or molecules up to 4A in diameter. This will trap oxygen molecules within its crystalline cage while argon atoms are rejected. Linde claim that the use of the sieves is so efficient that oxygen impurity can be reduced below 5 p.p.m.

Separation is carried out in the gas phase at Linde's commercial refinery. Pressure used is slightly above atmospheric and temperature is just above saturation temperature of the argon-oxygen mixture. The adsorbent which is hydrothermally precipitated as a fine white powder with average particle size of about 2 microns, is bonded with inert binder and extruded as pellets, 1/16 or ⅛ in. in diameter. These are activated by heating to drive off water of crystallisation, leaving a very porous crystalline structure.

In the commercial absorption system designed by Linde, there are three vertical, 20 ft. stainless-steel columns containing molecular-sieve pellets and equipped with internal and external cooling coils. Interconnecting piping permits any two of the columns to be run in series, while the third is regenerated.

Cooled, impure argon is passed through two of the columns in series at such a rate that contact time is about 30 seconds. When the first trap is saturated with oxygen (10% by weight of adsorbent), the piping is halved, so that the fresh trap becomes number two in the series. A small amount of heat is generated in the adsorption and is drawn off by liquid air circulating in the cooling coils. Pressure of the refrigerant is controlled to maintain gaseous argon-oxygen input at optimum operating temperature—180° to 175°C.

To regenerate a saturated trap, waste nitrogen is heated from Linde's air separation plant to 90°C, and is passed up through the bed to desorb the oxygen. When the top of the bed reaches 0°C, the heater is turned off and nitrogen flow continues until the entire bed is uniformly at ambient temperature. By then, desorption is complete. Dry air could also be used.

Before cooling the desorbed trap for return to the system, nitrogen is purged out with purified argon, warmed to room temperature. The trap is then refrigerated to operating temperature under a helium atmosphere and finally the cold trap is purged with purified argon and switched back into the system.

Linde report that using the molecular sieves, purity of their commercially bottled argon has been raised to 99.996%. Average analysis has indicated only 13 p.p.m. total impurities.

Electrostatic Desulphurisation Process in Operation at I.C.I.'s Billingham Refinery

NEW chemical engineering tool—electrostatic mixing—is used to remove sulphur efficiently in an electrostatic desulphurisation process used in conjunction with sulphuric acid contacting.

Developed by Howe-Baker Engineers, Inc. Tyler, Texas, U.S., the process is said to be particularly applicable to reformer feedstocks. An 8,000-barrel/day unit has been in use for over a year treating reformer feedstock at the East Chicago, Indiana, refinery of Cities Services, and a second unit of 2,000-barrel/day has been set up for Commonwealth Oil and Refining at Ponci, Puerto Rico, to treat cracked naphtha, and on stream this month at Imperial Chemical Industries' Billingham refinery is a 1,150-barrel/day unit.

Sulphur removal, according to Howe-Baker, can be as high as 95%. In a typical operation where sulphur is reduced from 300 p.p.m. to 22 p.p.m., arsenic also is reduced from 5-17 p.p.b. to 0-4 p.p.b. Treating losses are reported to be less than 0.5% with straight-run naphthas, but to increase with larger amounts of unsaturates and higher molecular weights in feedstock.

Cost of a 10,000-barrel/day unit is estimated at not more than $350,000 (£100,000 approximately). Total operating costs vary from 7.9 cents/barrel using fresh acid down to 4.8 cents/barrel if spent alkylation acid is used.

Electrostatic Mixing

Electrostatic mixing, Howe-Baker state (*Chemical Engineering*, 1959, **66**, No. 22, 26), uses electrical energy to accelerate conductive particles or ions in a non-conductive medium. Electrical energy transmitted to the system imparts violent and rapid motion to dispersed particles. Electrostatic mixing and electrostatic precipitation are distinguished by the company as follows: When voltage gradient is relatively low, polar or charged particles tending to align along lines of electrostatic force are nevertheless subject to local hydraulic eddy currents and are whirled about. Mixing is further promoted by resulting changes in local dielectric constant. Particles of acid or emulsion are whipped rapidly through the hydrocarbon phase.

In electrostatic precipitation, a much stronger field, about 10 times that for mixing, restrains conductive particles along the lines of electrostatic force. Particle mobility, except along the lines of force is practically nil until particles become so large that they precipitate out.

In the new process, naphtha feed enters a small vessel equipped with turbine-blade mixers, where sulphuric acid, 88-98%, is added and the solution is mixed, reducing acid particle size to an optimum diameter. Hydrocarbon containing the acid dispersion enters the bottom of the acid stage, where electrostatic mixing ensures maximum oxidation of sulphur compounds to disulphides. These latter are preferentially soluble in the acid phase which is continuously drawn off. The electrical field in the upper part of this reaction vessel effects virtually complete separation of hydrocarbon and sulphuric acid.

At the second stage, weak caustic neutralises sulphuric acid carryover, as well as small amounts of acidic reaction products and naturally occurring organic acids. Entrained acids are neutralised in the bottom of this stage, while caustic droplets coalesce in the upper part. A water-wash ensures final clean-up and naphtha passes to an activated alumina dryer.

A number of tests has been conducted by Howe-Baker on treated naphtha for sulphur, arsenic, chloride, lead and other contaminants. Results indicate that the process meets all performance of guarantees, removing over 90% sulphur. Discoloration tests to check for traces of high-boiling constituents have shown, it is reported, that naphtha contains less than that treated by hydrogen processes.

In the Cities Services' unit, some corrosion problems showed themselves; more caustic than should have been required was used at first. This was believed to be due to the presence of complex organic acids in the acid stage effluent. Corrosion was noted chiefly in the acid-contacting stage although some occurred in a later stage after incomplete neutralisation. Changing from recirculating caustic to a once-through system and pumping of a purge oil (dried naphtha product) through electrical insulator housings to prevent accumulation of conductive treating agents, have solved the above problems. Purge oil joins the main stream of naphtha being processed and a glass-wool coalescer has been added after the acid stage to prevent carry over.

ELECTROSTATIC OPERATING DATA

Naphtha charge: barrels/day	8,000
Temperature: deg. F.	80
Reaction stage:	
Acid circulation rate, lb./bbl.	12.5
Acid mixer speed, r.p.m.	120
Electrode power consumption, kW ...	1
Temperature. deg. F.	82
Insol. acid carryover, % by vol. ...	0.002
Neutralisation stage:	
Caustic circulation rate, bbl./day ...	400
Caustic mixing valve pressure drop, p.s.i.	8
Electrode power consumption, kW. ...	1
Temperature, deg. F.	85
Suspended caustic carryover, % by vol.	Nil to trace
Water wash:	
Water injection rate, bbl./day	400
Water mixing valve pressure drop, p.s.i.	4
Electrode power consumption, kW ...	1
Temperature. deg. F.	81
Suspended caustic carryover, % by vol.	Nil
Estimated yield loss, % by vol.	0.4

Simon-Carves Acid Division Reports Large-scale Home and Export Activities

PLANTS recently put to work in the acid division of the chemical plant department, Simon-Carves Ltd., include two sulphur-burning and waste heat recovery plants for the Dutch State Mines at Geleen, a 10-tons-a-day sulphuric acid plant for Malaya Acid Works Ltd., and the two oxidation units ordered by Imperial Chemical Industries for modernisation of their original cement/sulphuric acid plant built by themselves at Billingham in the 1930s.

At Amlwch in Anglesey, plant comprising modifications to convert the Associated Ethyl Co.'s flash-roasting sulphuric acid plant to sulphur burning has been completed and started up.

Simon-Carves (Africa) have successfully started up the sulphuric acid plant for Fisons at Sasolburg and expect shortly to commission the plant for Harmony Gold Mining, while in Egypt a 30 tons/day sulphuric acid plant is almost ready for commissioning for Société Misr de la Rayonne.

Two plants ordered through Heurtey, the firm's licensees in France, are approaching completion, as is the 60 tons/day sulphuric acid plant at the Durgapur steelworks, India.

Orders have been received from Parry Murray for a 50 tons/day sulphuric acid plant for Andhra Fertilisers at Tadepalle in India, and from Humphreys and Glasgow for waste gas disposal plant.

The firm have also been appointed main contractors to W. and H. M Goulding Ltd., the well-known fertiliser manufacturers, for design and construction of final developments of their Marina Works at Cork under a contract worth considerably more than £1 million. The development here includes a sulphuric acid plant and plants for production of single and triple superphosphates and compound fertilisers, together with associated handling and storing equipment.

I.C.I. Ammonia-from-oil Plant Now Commissioned

IN THE last week or so, I.C.I. Billingham Division has begun to make ammonia from the oil gasification plant, which was affected by an explosion during commissioning earlier this year (see CHEMICAL AGE, 25 April, p. 696). This was stated by Mr. W. J. V. Ward, division chairman, when he presented long-service awards recently. He added "we hope that we shall have another 50,000 tons of ammonia to help satisfy our customers".

The division expected to get oxygen across the Tees in the spring of 1960 and he thought that very shortly it would have a "new arrangement for rebuilding the oxygen plant".

Mr. Ward had stated that although the recent recession had led to some check on capital spending within the Division and I.C.I. as a whole, both the company and the division had "quite a few big plans for future development in plant and products".

Gas Research Meeting

PRIVATE FIRMS TO COLLABORATE IN PROCESS DEVELOPMENT

NEARLY 80 years ago researchers in the gas industry were concerned with doubtful or difficult questions relating to gas manufacture or science problems which, if solved, would not only increase the efficiency of the gas-making and utilisation processes, but would also relieve the gas manager of the day of some of his anxieties. They were not, however, faced with serious competition. The great difference today is that there is intense competition to meet, particularly from electricity and oil, and it is therefore essential that research should be so conducted as to pay us financial dividends. It has to help in carrying out the U.K. gas industry's policy of providing consumers with the best possible service at the lowest possible cost. This perhaps fundamental difference in the present-day approach to gas research problems to that 80 years ago was considered by Sir Harold Smith, chairman of the Gas Council, when he spoke on 'Research in the Gas Industry' to the 25th Autumn Research Meeting held in London on 17 and 18 November of the Institution of Gas Engineers. His review showed the gradual development of the gas industry's research organisation up to the advanced stage it has now reached.

Research Programme

It was when the gas industry was nationalised in 1949 that the conduct of research became one of the specific duties placed on the Gas Council by the Gas Act 1948, and there followed the establishment of Research Stations (see CHEMICAL AGE, 17 October, p. 523). The research programme changes from year to year although many of the projects listed do not alter since they take many years to complete. The list of projects in the Gas Council's research programme for the year ending 31 March 1960, included improvement and development of manufacture of gas from coal and oil at near atmospheric pressure; pressure gasification of coal in fixed fuel beds; gasification at pressure of powdered coal; development of the hydrogenation of coal at pressure in a fluidised bed; development of processes for production of hydrogen-rich gases by reactions at pressure; and catalytic gasification of light distillate at pressure. In the treatment of gas and its by-products projects include: improved removal of tar, naphthalene and ammonia from gas; improvement of the iron oxide process for removal of H_2S from gas; development of processes for removal of H_2S by liquid reagents; reduction of CO in gases rich in CO; study of catalysis and development of catalytic processes applicable to gas manufacture and purification and study of the problems of disposal of aqueous effluents. Sir Harold states that the Gas Council has been very pleased and encouraged that well-known firms of contractors (Henry Balfour and Co., Humphreys and Glasgow, Power-Gas Corporation, Simon-Carves, West's Gas Improvement Co., and Woodall-Duckham Construction Co.) have expressed their willingness to enter into licence agreements under which the results of research, particularly on gas-making processes involving high pressure, would be exploited commercially. These contractors will co-operate in the development of processes up to pilot-plant scale, and each of them has appointed a director or chief officer responsible for new developments to a Technical Advisory Committee with the director of the Society of British Gas Industries as its convenor. When a process proves successful on the pilot-plant scale, each of the contractors will be at liberty to develop it on a commercial scale. This is "an indication of the new gas industry that is evolving and in which research and development must play a leading part."

Expenditure on research has shown considerable increases. In 1918, of a Special Purpose Fund of £2,000, £1,350 was spent on actual research. In 1928 the figures were £8,000 and £5,000 respectively and in 1939 (the year the Gas Research Board was formed) they were £17,000 and £8,500. In 1948, the Institution on behalf of the industry subscribed £32,000 towards the Gas Research Board and the total expenditure of that Board reached about £80,000/year. These figures do not include expenditure by the Gas Light and Coke Co. and subsequently by North Thames Gas Board. In the year ending 31 March 1960, it is estimated that expenditure on research by the Gas Council will be about £850,000.

London Research Station's Work on Removing CO from Fuel Gases

THREE methods have been proposed for producing town gas of low carbon monoxide content; conversion of CO to methane or higher hydrocarbons by reaction with part of the hydrogen in the gas over a catalyst; absorption of CO in cuprous salt solutions which can be regenerated under vacuum; and conversion of CO to CO_2 and H by reaction with steam in the catalytic water gas shift reaction. The first two methods are considered as likely to be expensive, since both result in a loss of gaseous therms and require a high-temperature catalytic pretreatment to remove organic sulphur and oxygen. Hence these methods are more suitable for application to coal gas. The third method, however, is a high-temperature treatment of the same order of cost as the pretreatments for the first two, and it involves no thermal loss. Conversions of flue water gas in this way is well established, but complications have arisen in the treatment of gases of higher calorific value, such as carburetted water gas.

Considering the removal of CO from fuel gases, at the 25th Autumn Research Meeting of the Institution of Gas Engineers, G. S. Cribb and J. D. F. Marsh of the Gas Council's London Research Station, were concerned solely with the application of the water gas shift reaction to carburetted water gas. This method has been used to treat gas produced at Hameln and Nordhausen before the Second World War and at Basle since 1958.

Results obtained at Basle indicated that, when treating coke oven gas, the catalyst life is adequate if the nitric acid content of the gas is reduced to a low value. The rate of fouling on carburetted water gas may be significantly different, however, because the concentration of fouling constituents is different. Cribb and Marsh suggest that if the rate of fouling of standard chromia-promoted iron oxide on carburetted water gas is unduly high the cost of catalyst replacement could be replaced by: Finding a catalyst more resistant to fouling, or which can be regenerated without loss of activity; developing a cheap iron catalyst of adequate activity, which can be described when fouled; and, removing the constituents responsible for fouling before using the standard shift catalyst.

Work on Catalysts. Work being carried out at present at the London Research Station of the Gas Council is intended to determine which of the above three methods is preferable. It includes comparison of the activity of various catalysts, identification of the constituents of carburetted water gas responsible for catalyst fouling, comparison of catalysts for destruction of these constituents, and life tests of various catalyst combinations on carburetted water gas.

Laboratory tests have shown that fouling is rapid with gas containing nitric acid, oxygen and conjugated diolefins and that acetylene also contributes to loss in catalytic activity. With a relatively low nitric oxide content, about 0.1 p.p.m. of carburetted water gas treated, life of an unprotected catalyst may be "quite long". Nickel subsulphide on china clay has been found the most promising of the protective catalysts so far studied. Since it removes nitric oxide and butadiene in addition to oxygen, is active in the presence of steam and is comparatively cheap and easy to regenerate. The supported catalysts used for organic sulphur conversion, such as nickel and cobalt thiomolybdates and nickel subsulphide are not active for the water gas shift reaction. Cheap iron oxide catalysts of

moderate activity can be prepared, however, by impregnating Lux tablets in potassium dichromate solution; such a catalyst, it is thought, might be suitable for use in the first stage of a two-stage plant, with intermediate cooling.

CO_2 Removal Processes. If the CO_2 formed in the water gas shift reaction is removed from the treated gas in order to maintain its calorific value, gravity of the product will be considerably below that of the original gas. For this reason, and because of the high cost of CO_2 removal, close attention has been paid to the extent to which this is desired under a variety of conditions.

The methods for removal of CO_2 may be classified as follows: gaseous diffusion; adsorption by molecular sieves; absorption by solid reagents; physical absorption in liquid solvents; chemical absorption in liquid reagents; and refrigeration.

Gaseous Diffusion. To obtain the required degree of separation with thermal diffusion and gaseous effusion in practice, the heat or steam input would be prohibitive.

Adsorption by Molecular Sieves. In a three-bed system (adsorption-regeneration-cooling), CO_2 has been reduced from 11% to less than 0.1%, the dewpoint being lowered to below −75°F. As water vapour is preferentially adsorbed, this is a serious disadvantage, unless its complete removal is required. The molecular sieves are expensive, and for treatment of gases rich in CO_2, a short cycle is required. This in turn increases the regenerative heat requirement, since the beds have to be rapidly heated and cooled. Cribb and Marsh consider that this method may still prove attractive, but as yet there is insufficient data to assess the cost as applied to the duty under consideration.

Absorption by Solid Reagents. If lime or magnesia is incorporated in the water gas shift catalyst, CO_2 is absorbed as it is formed at about 500°C, and the carbonate can be regenerated at about 900°C. Such a process has been tried out in Germany on pilot-plant scale. The advantage of combining the shift and CO_2 removal into a single process is offset by lack of flexibility, there being no control over CO_2 removal. Also fuel cost for regeneration is estimated at 2d/therm of gas treated.

Adsorption

Physical Adsorption in Liquid Solvents. Normally the solvent used in water and because of the low solubility of the CO_2, absorption is carried out under pressure and the CO_2 liberated by flashing off at atmospheric pressure, followed by stripping of the water with air. The power required to circulate the water is high even though part of the energy can be recovered in a Pelton wheel and the net cost is high. For gases generated at atmospheric pressure, the cost of compression, solely for the purpose of CO_2 removal is also appreciable. Net cost of compression, based on 50% recovery is 2.5d/1,000 s. cu. ft. Third major running cost of the water wash process is the thermal loss resulting from solution of the combustible constituents of the fuel gas, amounting to about 2.5% of the thermal value and equivalent to a cost of 0.3d/therm. With 0.2d/therm for interest and depreciation, minimal total cast for CO_2 removal by water washing is 1.4d/therm.

Methanol may be used as a solvent for physical absorption of CO_2 as in the Lurgi Rectisol process. Since certain hydrocarbons are removed along with CO_2 and S compounds, the process would be a disadvantage if applied to fuel gases. Figures for cost of the process have not been published. The washing is carried out under pressure at −70°F, cold losses being made good by ammonia refrigeration. Absorptive capacity of the methanol under these conditions is 4 cu. ft./gall. and refrigeration is effected by reducing pressure on the cold solution.

Chemical Absorption in Liquid Reagents. The superiority of ammonia solutions for absorbing CO_2 has been recognised for a long time. However, although the presence of free ammonia facilitates absorption of CO_2, absorbent exerts an appreciably vapour pressure of ammonia as a consequence. This is the reason why ammoniacal solutions have not been more widely adopted for CO_2 removal, there being the added complication of a water wash and possibly of an effluent disposal problem.

Parallel Mechanism

The mechanism by which CO_2 is absorbed in solutions of ethanolamine parallels that for absorption by ammonia. It is calculated that in a cyclic process removing 20 vol CO_2 100 vol of untreated gas, the steam cost, on the basis of 60s/unit, would be 4.1d/1,000 s. cu. ft. of the original gas for methylamine (MEA). Another disadvantage of MEA is the irreversible reactions with carbon oxysulphide, carbon disulphide and other common constituents of manufactured fuel gases.

The conventional hot potassium carbonate process or Benfield process developed by H. E. Benson and J. H. Field, U.S. Bureau of Mines is reported as rapidly gaining favour as the most economical means of CO_2 removal from synthesis gas. It is particularly suited to the wasting of gases available at elevated temperature and pressure. When costs of the hot potash and MEA processes are compared, a CO_2 partial pressure of 20 lb./sq. in. is quoted as the break-even point. Above this concentration the hot potash process is the more economic. Also, a comparison between the costs of steam plus cooling water for this process and the additional power and thermal loss for the water wash, indicates a slight advantage for hot potash. A disadvantage is the complication on shutting down, since the operating concentration of carbonate is above that required to saturate the solution at ambient temperature.

Refrigeration. This process could only be applied where the gas is available at pressures of the order of 600 to 1,500 lb./sq. gauge. Power requirements for refrigeration are derived from expansion of CO_2 removed from its high initial pressure to atmospheric pressure. The compression costs, if this method were applied, would be excessive and hydrocarbons would be removed together with the CO_2.

A design study. It was decided to make a design study of a possible process, to erect a small pilot plant to check the validity of the assumptions made and to observe any practical difficulties that might arise. On the basis of the design study, a pilot plant has been erected at Fulham to absorb 100 s. cu. ft./hr. CO_2 from 500 s. cu. ft./hr. of carrier gas, using a 4.0N ammonia solution. As yet it has not been possible to absorb CO_2 at the required rate, due to difficulty in scaling the absorber down in height.

Preliminary results indicate that the heat of absorption is about 470 B.Th.U./lb. of CO_2, but the degree of heat exchange is limited and the absorptive capacity of the solution has not been fully utilised. No difficulty has been experienced in regenerating CO_2 at rates up to 70 s. cu. ft./hr. The most serious operating difficulty experienced so far is deposition in certain parts of the plant of solid formed by the combination of ammonia and CO_2 in the gas phase. Such deposits occur in the final condensers of concentrated liquor plants, and attention would have to be given to this problem in a full-scale plant.

A full-scale plant, Cribb and Marsh suggest, would consist of an absorption tower to remove CO_2 followed by a conventional ammonia washer to remove the ammonia. Rich liquor would be pumped under pressure through a heat exchanger and flashed into a simple regenerator. CO_2 evolved would be treated with a portion of the rich cold feed in an acid gas scrubber. Hot, regenerated liquor would return, *via* the heat exchanger and a cooler, to a weak liquor storage tank.

If there were no ammonia liquor system to accommodate the liquor from the ammonia washer, stripping still could be added to strip a small quantity of the hot regenerated liquor so as to maintain a water balance. Vapours from this still would pass directly to the regenerator as stripping steam. If waste heat could be utilised as suggested, it would be possible to remove at less than ½d/therm, over 50% of CO_2 in shifted carburetted water gas.

Disadvantages of ammonia are that it is volatile and that the plant solutions become corrosive, especially if impurities such as H_2S are present. Advantages are that it is a cheap reagent readily available within the industry, rate of absorption of CO_2 is high and heat requirements and temperature of regeneration are low. It is therefore believed that with such a process, it should be possible to reduce appreciably CO_2 content of shifted fuel gases at a cost that might be absorbed by the increased flexibility of gas production available.

Procon Refinery Projects

Letter of intent in connection with a projected oil refinery at Teneriffe, Canary Islands, has been granted to Procon (Great Britain) Ltd. by the Spanish oil company C.E.P.S.A. Procon were recently awarded a contract to build a refinery for S.A.C.O.R. of Portugal in Lorenco Marques, Portuguese East Africa.

Overseas News

W. R. GRACE TO ENLARGE NITROGEN PLANT FOR AMMONIA PRODUCTION INCREASE

THE RECENTLY announced expansion of the W. R. Grace and Co. nitrogen plant in Tennessee scheduled for completion by 1961, will bring the annual total ammonia capacity up to some 160,000 tons and is the second expansion following in the wake of the enlargement of the urea section, which doubled production during the autumn. Originally the capacity of the urea plant was 50,000 tons a year, and the added facilities bring the total to 100,000 tons, claimed to make it the third largest in the U.S. and the fifth largest in the world.

While contracts for the ammonia plant have not yet been placed an announcement will shortly be made and it is expected that the expanded facilities will parallel the present 300 tons per day ammonia stream. Economies will be made through operating integration, although the new plant will be capable of independent production. The process selected for the new plant consists of five major steps as follows: Primary and secondary high pressure (130 lb. per sq. in.) steam methane reforming; two steps of carbon monoxide shift conversion, each followed by a stage of carbon dioxide removal by monoethanolamine; methanation of residual carbon monoxide; synthesis gas compression; and 9,000 lb. per sq. in. Casale ammonia synthesis.

Fertiliser Plants Being Built By the Germans in India

Two large plants for the production of nitric acid are stated to be under erection at the Nangal-Bhakra Dam, in Northern India, by the West German constructional engineers Pintsch Bamag AG. The plants are attached to a works for the production of nitrogenous fertilisers.

Foreign Capital Builds Siam's Chemical Industry

Reports issued by the Thai Board of Investment, a branch of the Siamese Government, state that up to July of this year applications from non-Siamese interests to invest in Siam had been granted to some 20 concerns. These included companies interested in the production there of pharmaceuticals, sulphuric acid, potash, ammonium chloride and alum.

Shanghai Again Centre of Chinese Chemical Industry

Reports from Hong Kong show that the Chinese Government sees Shanghai as the leading industrial centre of the country, as it was in pre-Communist days. Last year alone a sum of approximately £142 million was invested in the city, a considerable share of this being taken up with the expansion of the local chemical production industry. Experimental production is reported to have started in plastics, synthetic fibres, synthetic rubber and heavy chemicals from mineral oil by-products, and coal sources.

Soda Ash Production Plans for Korea

The soda ash plant to be erected in Shamchok, Korea, as a result of the loan of some $5.5 million by the U.S. Loan Development Fund will produce some 39,000 tons of the basic product per annum. In addition it will turn out 2,500 tons of sodium bicarbonate and 5,000 tons of calcium chloride, and is expected to save Korea up to $4 million a year in foreign exchange.

Phillips to Build Carbon Black Plant in Italy

Two more carbon black plants are to be built by Phillips Petroleum—one in Texas and the other in Italy. Phillips' wholly owned subsidiary, Phillips Chemical, is to build a 60 million lb./year plant near Orange, Texas. It is scheduled to be completed in the third quarter of 1960.

To build and operate a 25 million lb./year carbon black plant in Italy, Phillips Petroleum are forming an Italian company with ANIC (Azienda Nazionale Idrogenazione Combustibli). Operation date for this plant is two years hence. Phillips have recently started construction of two other carbon black plants, one in South Africa and one in France.

New Du Pont Fibre

In a plant at present under construction at Waynesboro, Virginia, the E. I. Du Pont de Nemours and Co., U.S., are in the autumn of next year to start production of a new synthetic fibre, which is to bear the name of Lycra. Lycra is stated to be as elastic as rubber thread, to be easy to dye and may be washed by machine. It will be used primarily for the manufacture of swimming suits, foundation garments, sports clothing and similar items. A sum of $10 million has been spent on research, development and market research connected with the new fibre, which up till now has borne the provisional name of 'Fibre K'.

Japanese Interest in Baroda Rayon Corporation

One of the directors of the new Baroda Rayon Corporation Ltd., just formed in India with a capital of 100 million rupees is the Maharaja of Baroda. Three Japanese companies—Mitsubishi Shoji Kaisha Ltd., Mitsubishi Heavy Industry Co. and Asahi Chemical Industrial Co.—are to supply equipment for and attend to erection of a plant to be built by the company at Surat, in Bombay State. The Japanese concerns are to purchase shares in the corporation for 2,700,000 rupees. Sales agents of the company will be another concern in which the Maharaja has interests, Gaekwad Chinai and Co. Ltd.

Canadian Diethyl Toluamide

The first Canadian production of diethyl toluamide (DET) insect repellent, has started at the Elmira, Ontario, plant of Naugatuck Chemicals, Division of Dominion Rubber Co. Ltd.

The result of extensive screening tests to find a superior insect repellent for the armed services, diethyl toluamide was found to offer advantages in convenience and effectiveness over other chemicals used in this application. The Naugatuck product is the 95% *meta* isomer with less than 5% of the other related isomers.

Increase in Italian Chemical Exports

Italy exported 99,601 million lire worth of chemicals during the first three-quarters of 1959—about 24.7% more than in January/September 1958. These exports were subdivided as follows: Explosives and inflammable compounds, 1,332 tons (1,758, 1958); chemical fertilisers, 900,788 tons (590,331); pesticides for agriculture, 12,066 tons (13,781); rubber, natural and synthetic, plastics, synthetic resins, 41,674 tons (29,045); other organic chemicals, 89,762 tons (71,144); miscellaneous chemical products, 320,243 tons (357,134).

Spanish-German Chemical Link Projected

The Spanish chemical producers Hidro Nitro Española S.A. are reported to be conducting negotiations for a co-operation programme with the Spanish agents of two West German concerns, Knapsack-Griesheim AG, of Cologne, and Friedrich Unde GmbH, of Dortmund.

U.S.-Italian Pharmaceuticals Tie-up

Armour, of Chicago, and Carlo Erba, of Milan, are to start a programme of close co-operation in 'biological production' and research in the pharmaceutical field, and a joint subsidiary has been formed in Milan under the name of S.p.A. Armour-Erba through which the two concerns will work together.

East German Aromatics Production Planned

Aromatics production at the combined petrol and chemical works of VEB Kombinat 'Otto Grotewohl', of Böhlen, in East Germany is projected. It is considered that without lowering the quality of the fuel produced at the Böhlen plant totals of some 10,000 tonnes of xylol and 7,000 tonnes of ethyl benzole per year can be isolated and processed. Main

customer for these products would be the home plastics industry, and demand for the aromatics from Böhlen exists officially as from 1 January 1963, signifying that by this time facilities will have to be made available for production there.

Australia's Government-owned Synthetic Ammonia Plants

Because of expansion of the commercial chemical industry in Australia, and the current stocks and supply position of ammonium sulphate, the Australian Government has decided to retain in operation under the existing form of management and control, the synthetic ammonia plant at Mulwala, which can produce nitric acid, ammonium sulphate and methanol. The synthetic ammonia plant at Albion is being closed down but will be retained as reserve capacity. The synthetic ammonia plant at Ballarat has now been sold to Imperial Chemical Industries of Australia and New Zealand Ltd. (I.C.I.A.N.Z. Ltd.).

These Victoria plants, together with the synthetic ammonia plant at Villamood, New South Wales—already sold to I.C.I.A.N.Z.—were set up during the last war for the production of ammonia used in the manufacture of nitric acid for explosives. They are now managed and operated on behalf of the Australian Government by I.C.I.

Since the war the plants have been used mainly for the production of ammonium sulphate and to a lesser extent, in producing ammonium nitrate and methanol.

Carbon Black Plant for Pakistan

Final negotiations are at present taking place, it is announced, from Karachi, between the U.S. concern Constock International Methane and Pakistan Petroleum Ltd. with regard to plans for the erection of a 300,000-tons-a-year carbon black plant in the region of the Sui natural gas fields in Pakistan. The plant would be built with American financial backing, Pakistan having been chosen by U.S. interests for aid for such a scheme on the basis of its being the world's leading natural gas producer. Such a plant would produce two-thirds of the combined present U.S. carbon black output.

S.D. to Build Three More Maleic Plants for Monsanto

Scientific Design have been awarded contracts to design and build three new maleic anhydride plants for Monsanto Chemical Co. and for two further manufacturers. SD will design and construct the 20-million-pound-per-year addition to Monsanto's existing 40 million-pound capacity maleic anhydride plant in St. Louis, Missouri. It is estimated that the new plant will be on stream by mid-1960.

Pittsburgh Coke and Chemical Co.'s recently announced 20 million-pound-per-year maleic anhydride plant will also be designed and built by SD. This plant, scheduled to go on stream early in 1961, will be located at the company's main plant at Neville Island, Penn.

In Canada, the firm will design and build a new maleic anhydride plant for Monsanto Canada Ltd., Ville La Salle, Montreal. The 6 million-pound-per-year plant is scheduled for completion in the fourth quarter of 1960.

Polypropylene Fibre for Industrial Rayon

Industrial Rayon, U.S., are to produce polypropylene staple fibre, tow and continuous filament yarns on a semi commercial scale at their Covington, Va, plant, where they now have nylon and rayon facilities. The polypropylene products will carry the trade name Prolene.

The company have had a pilot plant in Cleveland and polypropylene production is to continue there also.

U.S.S.R.-German Chemical Plant-for-oil Pact

Under a barter agreement drawn up between Soviet Russian and West German interests, several hundred thousands of tonnes of Russian crude oil are to be imported into Germany from Russia for processing into petrochemicals by the Gelsenkirchen firm of Scholven-Chemie AG. In return for the oil a complete plant for the production of polythene will be exported by West Germany to the Soviet Union. Under a similar agreement signed earlier this year—also for crude oil for Scholven-Chemie—steel roller mill equipment was sent in exchange.

National Distillers to Set Up Swiss Subsidiary

National Distillers and Chemical Corporation, of New York, announce that they are planning to open a subsidiary in Switzerland. With this in mind, the company has purchased some 6,000 square metres of land at Baar, near Zug, where a marketing centre for Europe, Africa and the Near East, will be built together with sales laboratories. Total investment needed for the Baar headquarters is estimated at S.Frs.2 million, or some £167,000.

New Anti-knock Compound For Car Fuel

Ethyl Corporation, New York City, U.S., have developed a new anti-knock compound for motor gasoline. The new preparation is a mixture of tetraethyl lead (TEL) and methylcyclopentadienyl manganese tricarbonyl—trade name Motor 33 Mix. Compared to the use of TEL alone, it is stated that 3 ml. of TEL as Motor 33 Mix can add up to 3 octane numbers to the usual petrols.

Epoxidised Products by Continuous Process

Becco Chemical, division of Food Machinery and Chemical, Buffalo, N.Y., have developed a continuous process to make epoxidised products. An unsaturated oil such as soya bean oil, an organic acid and hydrogen peroxide are used. The compounds are run countercurrently into the top of a packed column; the resulting epoxidised product and spent reagents are removed continuously at the other end.

Chinese Output Figures Increase

Figures issued from Pekin last week show that in the first nine months of the current year some 886,000 tonnes of synthetic fertilisers and 91,000 tonnes of pesticides have been produced in the Chinese Communist republic. These outputs show increases of 24.5% on the same period of last year in the case of fertilisers and as much as 58% increase for pesticides.

Merox Process for Refining Petroleum

NOW available for licence to refiners is a catalytic process for removing sulphur compounds from a wide range of gasoline and light distillate oils. Developed by Universal Oil Products (U.O.P.), Des Plaines, Illinois, the Merox process is reported to be able to remove mercaptans from gasoline and lower-boiling fractions, or, where extraction of sulphur is not required, stocks can be sweetened by converting the mercaptans to disulphides.

Alkyl mercaptans are catalytically oxidised to disulphides in a sodium hydroxide solution at ambient temperatures and using atmospheric oxygen. The disulphides formed are insoluble in sodium hydroxide but soluble in oil. Depending on the separation technique they can be removed from the oil or left behind. Sodium mercaptide and water are also formed.

Conventionally sodium hydroxide solution containing sodium mercaptide is regenerated by stripping with steam at the solution's boiling point. Steam consumption and the corrosive nature of the hot NaOH solution make this method expensive, it is claimed. In the Merox process, air is blown through the NaOH solution containing mercaptide in the presence of a catalyst (unnamed), after separating the solution from the gasoline. Disulphides formed are insoluble in the solution and can be removed by a gravity separator. Sodium mercaptide is converted to sodium hydroxide. The NaOH solution is then ready for re-use.

Investigations by U.O.P. indicate that the Merox process can be used to process sour stocks to commercial and military jet specifications at low cost. The process has the added advantage of avoiding copper chloride or sodium plumbite sweetening.

In using the process for both sweetening and extraction, the catalyst can be employed in two ways: in solution in the caustic, or, when greater activity is needed, on a carrier in a fixed bed. Catalyst life is reported to have exceeded 20,000 barrels/lb. Based on this figure, U.O.P. state that catalyst cost will be less than 1/10 of a cent per barrel of oil treated in commercial units.

AVOIDING CHEMICAL ENGINEERING PITFALLS IN PIPERAZINE

By

Dr. M. A. Phillips*

To obtain the yields described, avoidance of chemical engineering pitfalls of (a) corrosion due to the use of ammonium chloride at the high temperatures used, and (b) if the obvious choice of glass-lined metal plant is adopted, the process must be more or less continuous to prevent failure of the plant due to frequent and sudden changes of temperature at the interruptions, whether these are due to breakdown or to batch-working.

PIPERAZINE salts, notably the adipate, are used as anthelmintics in clinical and veterinary practice; this salt and others such as the citrate and phosphate can be made by neutralisation of the base in aqueous solution with the appropriate acid, followed by concentration and crystallisation

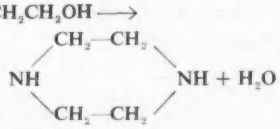
The base exists as anhydrous material and also as a hexahydrate, $C_4H_{10}N_2.6H_2O$ containing about 56% of water. The anhydrous base is a water soluble solid of b.p. 140°C and m.p. 104°C. The hexahydrate m.p. 44°C will crystallise from such aqueous solutions which are strongly alkaline. There are several methods of preparing piperazine and its hydrate as intermediates for the salts; all depend upon ring closure from two molecules of a —C—C— structure or from one molecule of a —N(C—C—)$_2$ structure.

An early method, due to Ladenburg (**1**), consists of heating together the compounds ethylene dihydrochloride and ethylene dibromide; this does not give high yields. Morera (**2**) condensed aniline with ethylene dibromide, nitrosated the product and then hydrolysed the dititroso compound (**A**) with mineral acids.

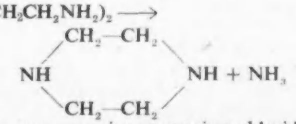
This roundabout method is not economic as regards manufacture.

Piperazine has also been obtained from ethylene diamine at 400°C using aluminium phosphate catalyst (**3**), from hydroxyethyl aminoethyl amine (**B**) and alumina at 240°C (**4**) or with copper catalysts (**5**), from di (β-aminoethyl) amine and Raney nickel (**6**) and from diethanolamine with Raney nickel, copper chromite, zinc, aluminium and other metals (**7**, **8**). Piperazine can also be made from monoethanolamine heated at about 240-250°C with ammonium chloride and this method forms the basis of a well-known method of manufacture. Ammonium chloride with di (β-aminoethyl) amine (sometimes called diethylene triamine) under similar conditions also gives piperazine; the yields in both cases are similar and may be economic in certain circumstances. The mono and diethanolamine methods are preferred in Europe, but the diethylene triamine method is used in the U.S. where this intermediate is readily available:

$2NH_2CH_2CH_2OH \longrightarrow$



$NH(CH_2CH_2NH_2)_2 \longrightarrow$



The processes using ammonium chloride can give rise to much corrosion troubles and enamel or glass-lining is only a partial solution to this problem on account of the relatively high temperatures involved. Stainless steels are not of much use, certain silicon-copper alloys are serviceable, but most users employ good quality glass linings and replace when troubles arise.

The plant thus consists of a reactor, a still into which the reaction mixture is charged and from which all mixed volatile bases are steam distilled after salting out with excess caustic soda, followed by a fractionating still from which piperazine is distilled as strong aqueous solution and a setting vessel for crystallisation of piperazine hexahydrate. At this last stage, water is added to the aqueous distillate from the fractionating still to give a crystallising mixture. Mother liquors are re-used in the usual way.

Yields of piperazine base from monoethanolamine and ammonium chloride can be of the order of 65-70% of theory which is economic, but this can only be realised in full-scale operation if there is no corrosion, which makes the use of metal of any kind impracticable; this is the main reason for the failure of the process in such cases.

Glass-lined vessels are the most desirable and to ensure a long life for these it is necessary to avoid any frequent stoppages, either due to batch working or to breakdown. Any partial failure of the glass lining, due to differential expansion of glass and metal, will initiate a vicious circle if any metal begins to show through, so that in such cases a standby plant is desirable, to be used while the first vessel is being lined.

Hence, the process must be well-tried on pilot scale and, on upscaling, there must be no breakdown due to inefficient working. Continuous or semi-continuous working is indicated and if there has to be a shut down, cooling off of the glass-lined vessels and subsequent heating up must be done gradually.

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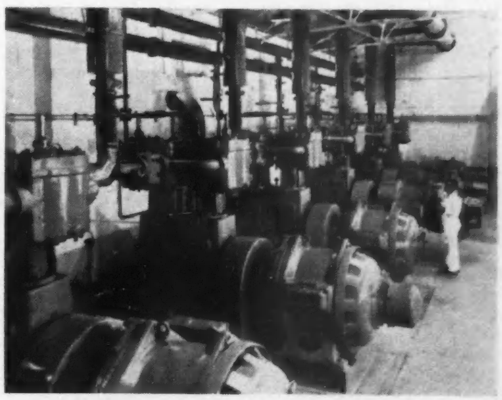
Styrene Co-Polymers to Make U.S. Resins

AGREEMENT has been reached between Pittsburg Plate Glass International and Styrene Co-Polymers Ltd., 1 Roebuck Lane, Sale, Cheshire, whereby the latter have the right to manufacture under licence and to market in the U.K., Scandinavia and certain other countries the Duracron range of thermosetting acrylic resins covered by the broad patent position of the Pittsburg Plate Glass Co.

This range of resins will be marketed under the name Scopacron and will include thermosetting acrylic resins corresponding to the Duracron range of materials already established in the U.S.

The resins are produced by the reaction of long-chain interpolymers containing amide side groups with formaldehyde. The basic advantage claimed for these new products over the existing thermosetting resins (such as phenolics, urea and melamine resins) is that desirable properties of adhesion, flexibility and film hardness are built into the molecule by the use of different polymerisable vinyl monomers.

Broomwade Compressors at Pfizer's



Pfizer's modern factory in Kent, producing wide ranges of antibiotics, uses 'Broomwade' SS2 two-cylinder compressors of the double-acting, dry cylinder type. During adiabatic compression, cylinder heat partly sterilises the air, which then passes through glass-wool filters before reaching the fermentation tanks

● **Mr. R. Shacklady, C.A.,** is joining the board of Witco Chemical Co., Bush House, Aldwych, London W.C.2, as joint managing director. **Mr. C. C. Hallett,** present managing director, will continue in the post until his retirement in August 1962.

● **Dr. Charles Simons, B.Sc., Ph.D., F.R.I.C.,** a barrister-at-law and a member of the council, Royal Institute of Chemistry, has been appointed as an R.I.C. representative on the Chemical Council for a three-year period beginning 1 January next. Dr. Simons is production manager for Weddel Pharmaceuticals Division of the Union International Co. Ltd.

● **Mr. K. Nave** will take over chairmanship of Turner Asbestos Cement Co. on 1 January, when **Mr. R. M. Bateman** relinquishes the post to devote his full time to the parent company Turner and Newall, of which he is deputy chairman.

● **Dr. J. W. Barton, B.Sc., Ph.D. (Bristol)** has been appointed to the staff of Bristol University as lecturer in organic chemistry.

● **Mr. A. F. Thomas, B.A., B.Sc., D.Phil. (Oxford),** has been appointed lecturer in the department of organic chemistry, Leeds University.

John C. Weyrich, newly appointed manager of Du Pont's Maydown Works at Londonderry, N. Ireland, previously held managerial positions in the firm's neoprene synthetic rubber plants in the U.S.

● **Mr. E. Booth** has been elected a member of the council of the Society of Dairy Technology. Sales manager of Reddish Chemical Co. Ltd., of Cheadle Hulme, Mr. Booth has been connected with the dairy industry for over 20 years. He is also a director of Reddish Detergents Ltd.

● **Dr. R. C. Swain,** vice-president and a director of American Cyanamid Co., has been appointed director general of Cyanamid International. **Mr. S. C. Moody,** former Cyanamid International director general, will continue as Cyanamid's staff vice-president for international relations. **Dr. R. O. Roblin,** former general manager, Commercial Development Division has been appointed a vice-president and will assume Dr. Swain's former staff responsibilities in the supervision of Cyanamid research. He will also direct commercial development engineering and construction.

Dr. Swain, who joined Cyanamid in 1934 and became vice-president in 1946, was a consultant to the United States Office of Scientific Research and Development from 1943-1945. He later served as a member and chairman of the Chemical Warfare Committee of the Department

PEOPLE in the news

of Defence's Research and Development Board, and in April 1953 received the Castner Memorial Medal in London.

Mr. S. C. Moody directed the organisation of Cyanamid International which has been operating in Europe since January 1958.

● **Mr. M. Flower, B.A. Economics (Cambs.),** has been appointed personal assistant to Mr. S. Majaro, sales director of Iridon Ltd. (Commercial Plastics Ltd., 75 Grosvenor Street, London W.1), and **Mr. A. F. Upton,** formerly with B.X. Plastics Ltd., is to be sales office manager. Both appointments have been created in view of Iridon's expanding activities.

● **Sir Lindor Brown, C.B.E., F.R.S.,** biological secretary of the Royal Society, has been appointed chairman of the consultative committee set up to advise the Department of Scientific and Industrial Research on the services of the National Lending Library for Science and Technology.

Among the committee members appointed are **Dr. R. E. Fairbairn,** head of the library department, I.C.I. Dyestuffs Division; **R. M. Fishenden, B.A.,** U.K. Atomic Energy Research Establishment; and **Professor G. Gee, F.R.S.,** of Manchester University.

● **Professor C. F. Carter** has been appointed by the Minister for Science to be a member of the Council for Scientific and Industrial Research. He takes the place of **Professor E. A. G. Robinson,** who retires on completion of his period of service. Professor Carter is Stanley Jevons Professor of Political Economy and Cobden Lecturer in the University of Manchester.

● **Mr. R. Ratcliffe,** deputy controller of Royal Ordnance Factories, has been appointed controller by the War Office. Control of most of the Royal Ordnance Factories, previously under the former Ministry of Supply, has been transferred to the War Office. **Sir Steuart Mitchell,** formerly controller of the Royal Ordnance Factories, has been appointed controller of guided weapons and electronics by the Ministry of Aviation.

● **Mr. J. W. Baggett,** secretary of United Gas Industries, has been appointed to the boards of the subsidiary companies, Dowson and Mason, Metal Units, and Vacuum Metallurgical Developments.

● **Mr. C. H. Flurscheim, B.A., M.I.E.E., Mem.A.I.E.E.,** a director and the chief electrical engineer of Metropolitan Vickers Electrical Co. Ltd., has been co-opted to serve on the council of the British Welding Research Association.

● **Mr. Stuart W. Don** and **Mr. Wilfred D. Wickenden** have been elected vice-presidents of the Chemical Bank New York Trust Co. They will be joint managers in charge of the company's new London office which opens in December at 25-31 Moorgate, London E.C.2.

● **Dr. Eric M. Hunt, B.Sc., Ph.D. A.R.I.C., A.M.I.Chem.E., F.P.I.,** is resigning from Shell Chemical Co. Ltd., with effect from 30 November, to join the board of Utilex Ltd., Kingston-on-Thames, manufacturers of plastics films. **Mr. T. J. Finch,** previously works manager of Utilex, has been appointed to the board. Dr. Hunt entered the plastics industry in 1946 as the colour chemist with B.X. Plastics Ltd., at Dundee. In 1949 he joined Erinoid Ltd. at Stroud as manager of the extrusion department from which he was transferred in 1951 to London. In 1955 Dr. Hunt was appointed general manager of Styrene Products Ltd. which was acquired by Shell in 1956 by their purchase of the Erinoid shareholding following the acquisition in 1955 of Petrochemicals.

Telcon's Bid for Plastics Sheet Market

THERMOPLASTIC sheet is now in production at the Farnborough works of The Telegraph Construction and Maintenance Co., who are making a bid for a share of the market in plastics sheet, increasingly used in industry for refrigerator linings and chemical vessels, etc.

Strong demand for polythene and polystyrene sheet will centre production initially on these, though if demand justifies, the £36,000 extruder installed, which is designed to process all thermoplastic lines, is likely to produce sheet in polypropylene, p.v.c. and other materials.

Contracts Signed for Winfrith Reactor

A CONTRACT has been placed by the Atomic Energy Authority with the Hawker Siddley Nuclear Power Co. for the purchase of a reactor to be installed at the Atomic Energy Establishment, Winfrith, Dorset, to be in operation by December 1960. Contracts for shielding and other equipment associated with the reactor are being placed.

The reactor, known as Nestor, is based on the company's Jason reactor. Its purpose will be to provide the neutrons required for the experimental assemblies of nuclear fuels and moderators which are used to obtain data for the design of future reactor systems.

Commercial News

• Half Glaxo's Turnover from Subsidiaries
• A & H's Group Net Profit Increase
• Gallenkamp's Acquisition of A. J. Towers
• Dow Chemie Unsuccessful in Raising Loan

Glaxo Laboratories

For the first time, subsidiary companies of Glaxo Laboratories Ltd., which include Murphy Chemical Co. and Allen and Hanburys, at home and abroad have contributed over half of Glaxo's total turnover and profitability, reports chairman Sir Harry Jephcott in his review of the year ended 30 June 1959.

Because the speed of technical advance makes for an exceptional high rate of obsolescence, general capital reserve (including obsolescence and replacement) has been increased by £500,000, and expenditure under research and development for which a reserve roughly equal to 12 months' expenditure was set up has doubled, so that the reserve here has been increased accordingly.

Antibiotic Exports. Deterioration in trading in export markets during the first half of the financial year was severe and widespread, particularly for penicillin and streptomycin. A significant loss of turnover was suffered and for a period Glaxo's fermentation facilities were not operated at capacity. Since the beginning of 1959, the overall position has improved. Achievement of further manufacturing economies has strengthened the company's position at home. It is reported also, that the market for antibiotics shows some signs of restored stability although some business is being conducted at low and barely remunerative price levels.

Trading results are stated to owe a good deal to the steady progress in the year by Allen and Hanburys, by Murphy Chemicals Co. and Glaxo overseas companies. The parent's trading position has been strengthened in the last few months by the introduction of new products, the chairman reports and, in particular, by Grisovin (griseofulvin), an oral fungicide.

Research. In view of technical competition, Sir Harry states: "We must view with considerable concern the relatively small expenditure on medical and pharmaceutical research in the United Kingdom compared with the weight of effort now being put into such research overseas, particularly in the United States, the Common Market countries and Japan." Since research in this field becomes increasingly costly as the techniques employed and the conditions with which it is concerned grows more complex, the size and depth of Glaxo's research programme "despite its mounting cost, must be progressively increased, for it becomes more and more vital to our continued prosperity".

Overseas Investment. Of greater long-run significance is a progressive improvement of recent years in the aggregate rate of return on overseas capital, reflecting the maturing of a number of major projects undertaken some years ago. Important new developments are under way at the moment, Sir Harry reports. In India Glaxo are bringing into operation highly complex plant for the manufacture of synthetic vitamin A and corticosteroids. In West Africa the company have begun to develop what they hope will become a large and diversified business in foods and pharmaceuticals. A factory has recently been opened in Malaya and a factory extension is being constructed in Argentina.

Organisation for Export. A combined export organisation has been established with a threefold function: to conduct export activities hitherto separately conducted by Glaxo and Allen and Hanbury's; to assist the process of unification already taking place overseas; and to service the continuing and growing needs of the overseas subsidiary companies. To give legal form to this joint activity, a new subsidiary is to be incorporated, known as Glaxo-Allenburys (Export) Ltd.

Allen and Hanburys

Allen and Hanburys (subsidiary of Glaxo) announce a group net profit for the year to 30 June, 1959, is £335,228 (£200,333), and dividend is 30% (17½%).

Bush, Beach and Segner Bayley

The share capital of Bush, Beach and Segner Bayley Ltd., has been acquired by Grovewood Securities Ltd. Miss E. M. Mason retires from the board and J. P. C. Danny has been appointed director.

Scottish Tar Distillers

Final dividend was 4½%, making 6½% for year ending 30 June, 1959 (6¾% equivalent). Trading profit, etc., £194,221 (£240,331). Net profit £77,752 (£74,496), after tax was £59,444 (£110,397).

A. Gallenkamp

A. Gallenkamp and Co. Ltd., Technics House, Sun Street, London E.C.2, have completed acquisition of J. W. Towers and Co. Ltd. by the purchase of all the Ordinary shares. The new board of J. W. Towers and Co. Ltd. is: A. W. A. Rundle (chairman), J. S. Towers, J. P. Oldfield, H. F. Kirby. H. Ditchfield has been appointed company secretary. Mr. J. S. Towers will continue to hold office as managing director until the end of 1959, when Mr. J. P. Oldfield takes over.

Dow Chemie

The loan raised in Switzerland by Dow Chemie AG, of Basle, the Swiss subsidiary of Dow Chemical, U.S., is reportedly unsuccessful. The Basle company, on which Dow plan to build up a whole European business framework, had issued papers over Swiss Frs.60 million, or £5 million, the loan to be at an interest rate of 4½%, and it is said, according to reports from Berne, that a considerable share of the planned loan has not been accounted for by the banking interests concerned.

Merck and Co.

Merck and Co., U.S., have declared a quarterly dividend, payable 2 January, of 40 cents (35 cents) on common stock, and an extra of 20 cents (same).

Market Reports

LOWER PRICES FOR COPPER SULPHATE

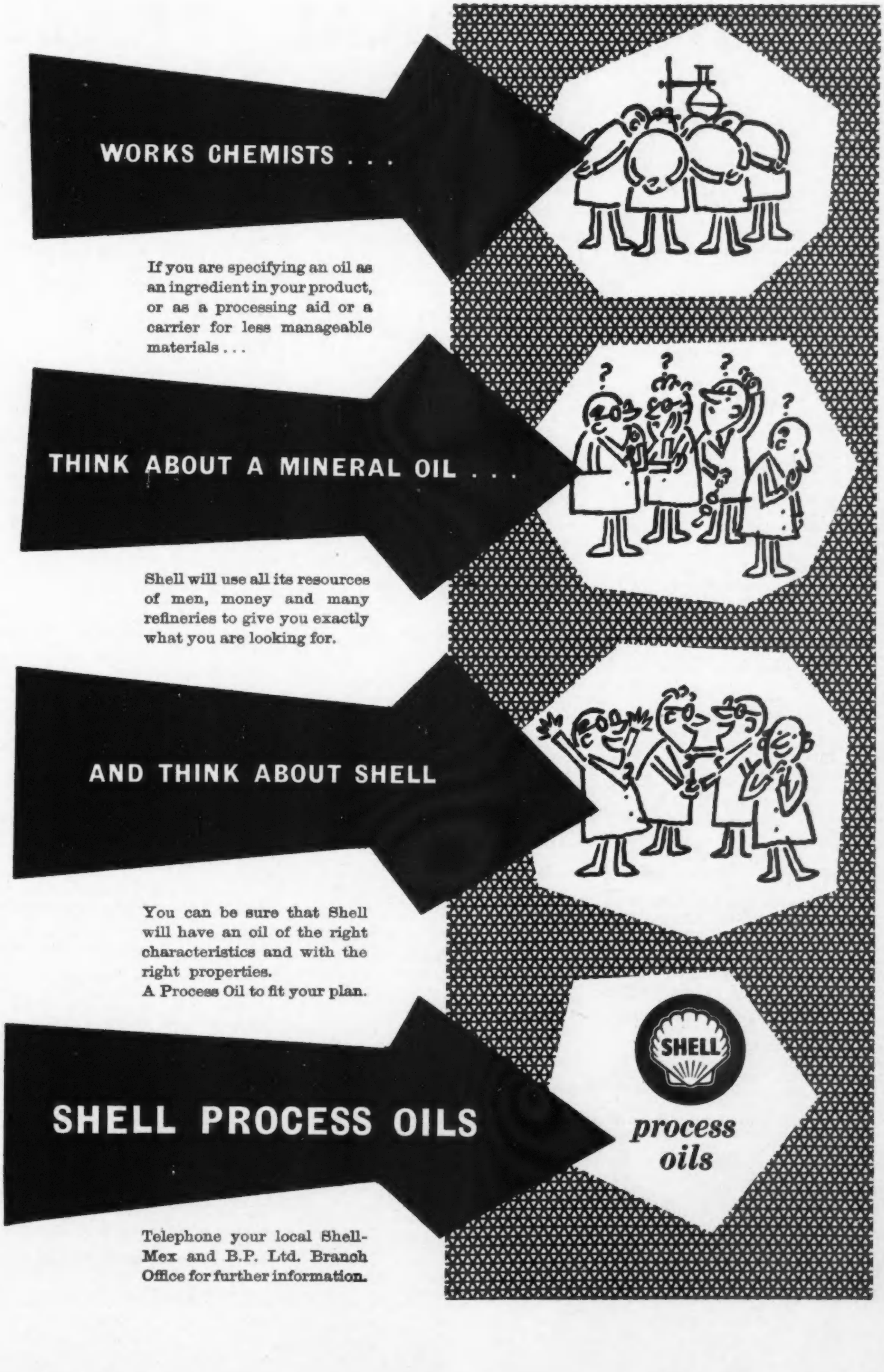
LONDON Home trade demand for industrial chemicals continues to be maintained at a good level, and a fair amount of new inquiry for forward delivery has been reported. There have been no signs of contraction in export trade and a steady flow of new inquiry has been reported, mainly for Commonwealth destinations.

Prices for the most part are unchanged and firm. Zinc oxide continues to fluctuate with the price of the metal, and sulphate of copper is lower at £78 10s per ton less 2% f.o.b. Liverpool. This change came into operation on 21 November 1959.

There has been nothing of fresh importance in the agricultural chemicals market and the demand for fertiliser materials remains steady; while the coal tar products section has been fairly active with most items finding a ready outlet.

MANCHESTER While chemical prices generally maintained a steady course, actual changes on balance have been mostly downward. Sulphate of copper is cheaper at £78 10s per ton, and there have been cuts ranging from £5 to £8 a ton in butyl and ethyl acetates and isopropyl acetate. Most chemicals have met with a steady demand on both home and shipping accounts, and a fair number of fresh inquiries have been in the market. The call for basic slag, in the fertiliser section, has again been brisk, and the compounds and nitrogenous materials are attracting attention.

SCOTLAND The trading position has been one of continued activity during the past week in most sections of the Scottish heavy chemical market. Demands have been varied and quantities involved have, if anything, shown a slight increase. Deliveries against contract requirements have also been well requisitioned. There has also been a volume of enquiries with quite a prominence to next year's requirements. Prices have remained more or less steady, and a reasonable level of activity is still being shown in regard to exports.


WORKS CHEMISTS . . .
If you are specifying an oil as an ingredient in your product, or as a processing aid or a carrier for less manageable materials . . .
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BRITISH CHEMICAL PRICES

GENERAL CHEMICALS

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £97; 80% pure, 10 tons, £103; commercial glacial, 10 tons, £106.

Acetic Anhydride. Ton lots d/d, £128.

Alum. Ground, f.o.r., about £25. MANCHESTER: Ground, £25.

Aluminium Sulphate. Ex-works, d/d, £15 10s to £18. MANCHESTER: £16 to £18.

Ammonia, Anhydrous. Per lb., 1s 9d-2s 3d.

Ammonium Chloride. Per ton lot, in non-ret. pack, £33 2s 6d.

Ammonium Nitrate. D/d, 4-ton lots, £31.

Ammonium Persulphate. Per cwt., in 1-cwt. lots, d/d, £6 13s 6d; per ton, in min. 1-ton lots, d/d, £123 10s.

Ammonium Phosphate. Mono-and di-, ton lots, d/d, £106 and £97 10s.

Antimony Sulphide. Per lb., d/d UK in min. 1-ton lots; crimson, 5s d/d to 5s 5½d; golden, 3s 3½d d/d per lb. to 4s 8½d d/d.

Arsenic. Ex-store, £45 to £50.

Barium Carbonate. Precip., d/d, 5-ton lots or more, bag packing, £41.

Barium Chloride. 2-ton lots, £46.

Barium Sulphate [Dry Blanc Fixe]. Precip. 2-ton lots, d/d, £39.

Bleaching Powder. Ret. casks, c.p. station, in 4-ton lots. £30 7s 6d.

Borax. Ton lots, in hessian sacks, c.p. Tech. anhydrous, £70; gran., £47; crystal, £50 10s; powder, £51 10s; extra fine powder, £52 10s; BP, gran., £56; crystal, £59 10s; powder, £60 10s; extra fine powder, £61 10s. Most grades in 6-ply paper bags, £1 less.

Boric Acid. Ton lots, in hessian sacks, c.p. Comm., gran., £78; crystal, £87; powder, £84 10s; extra fine powder, £86 10s; BP gran., £91; crystal, £99; powder, £96 10s; extra fine powder, £98 10s. Most grades in 6-ply paper bags, £1 less.

Calcium Chloride. Ton lots, in non-ret. pack; solid and flake, about £15.

Chlorine, Liquid. In ret. 16-17 cwt. drums d/d in 3-drum lots, £41.

Chromic Acid. Less 2½%, d/d UK, in 1-ton lots, per lb., 2s 2¾d.

Chromium Sulphate, Basic. Crystals, d/d, per lb., 8½d; per ton, £79 6s 8d.

Citric Acid. In kegs, 1-4 cwt. lots, per cwt. £9 18s 6d; 5 cwt. lots, up per cwt., £9 15s; packed in paper bags, 5 cwt. lots, up, per cwt., £9 8s 6d.; 1-4 cwt. lots, per cwt., £9 13s 6d.

Cobalt Oxide. Black, per lb., d/d, bulk quantities, 13s 2d.

Copper Carbonate. Per lb., 2s 1d.

Copper Sulphate. £78 10s. per ton less 2% f.o.b. Liverpool.

Cream of Tartar. 100%, per cwt., about £11 12s.

Formaldehyde. In casks, d/d, £40.

Formic Acid. 85%, in 4-ton lots, c.p., £91.

Glycerine. Chem. pure, double distilled 1.2627 s.g., per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons, £12 1s 6d. Refined technical grade industrial, 5s per cwt. less than chem. pure.

Hydrochloric Acid. Spot, per carboy, d/d (according to purity, strength and locality), about 12s.

Hydrofluoric Acid. 60%, per lb., about 1s 2d.

Hydrogen Peroxide. Carboys extra and ret. 27.5% wt., £119 0s 0d; 35% wt., d/d, £143.

Iodine. Resublimed BP, under 1 cwt., per lb., 11s; for 1-cwt. lots, per lb., 10s 6d.

These prices are checked with the manufacturers, but in many cases there are variations according to quality, quantity, place of delivery, etc. Abbreviations: d/d, delivered; c.p., carriage paid; ret., returnable; non-ret. pack., non-returnable packaging; tech., technical; comm., commercial; gran., granular.

All prices per ton unless otherwise stated

Iodoform. Under 1 cwt., per lb., £1 2s 4d for 1-cwt. lots, per lb., £1 1s 8d, 5 cwt., per lb., 21s 1d, crystals, 3s more.

Lactic Acid. Pale tech., 44% by wt., per lb., 14d; dark tech., 44% by wt., per lb., 9d; chem. quality, 44% by wt., per lb., 12½d; 1-ton lots, ex-works, usual container terms.

Lead Acetate. White, about £154.

Lead Nitrate. 1-ton lots, about £135.

Lead, Red. Basic prices: Genuine dry red, £105 15s; orange lead, £117 15s; Ground in oil: red, £126 5s, orange, £138 5s.

Lead, White. Basis prices: Dry English in 5-cwt. casks, £117 10s; Ground in oil: English, 1-cwt. lots, per ton, £136 10s.

Lime Acetate. Brown, ton lots, d/d, £40; grey, 80-82%, ton lots, d/d, £45.

Litharge. In 5-cwt. lots, £107 15s.

Magnesite. Calcined, in bags, ex-works, about £21.

Magnesium Carbonate. Light, comm., d/d, 2-ton lots, £84 10s under 2 tons, £97.

Magnesium Chloride. Solid (ex-wharf), £17 10s.

Magnesium Oxide. Light, comm., d/d, under 1-ton lots, £245.

Magnesium Sulphate. Crystals, £16.

Mercuric Chloride. Tech. powder, per lb., for 1-ton lots, £1 1s; 5-cwt. lots, in 28-lb. parcels, £1 1s 3d; 1-cwt. lots, £1 1s 6d.

Mercury Sulphide, Red. 5-cwt. lots in 28-lb. parcels, per lb., £1 10s 6d; 1-cwt. lots, £1 11s.

Nickel Sulphate. D/d, buyers UK, nominal, £170.

Nitric Acid. 80° Tw., £35 2s.

Oxalic Acid. Home manufacture, min. 4-ton lots, in 5-cwt. casks, c.p., about £133.

Phosphoric Acid. Tech. (s.g. 1.700) ton lots, c.p., £100; BP (s.g. 1.750), ton lots, c.p., per lb., 1s 4d.

Potash, Caustic. Solid, 1-ton lots, £95 10s; liquid, £36 15s.

Potassium Carbonate. Calcined, 96/98%, 1-ton lots, ex-store, about £76.

Potassium Chloride. Industrial, 96%, 1-ton lots, about £24.

Potassium Dichromate. Gran., per lb., in 5-cwt. to 1-ton lots, d/d UK, 1s 2¼d.

Potassium Iodide. BP, under 1-cwt., per lb., 7s; per lb. for 1-cwt. lots, 6s 10d.

Potassium Nitrate. 4-ton lots, in non-ret. pack, c.p., £63 10s.

Potassium Permanganate. BP, 1-cwt. lots, per lb., 1s 11¾d; 3-cwt. lots, per lb., 1s 11½d; 5-cwt. lots, per lb., 1s 10¾d; 1-ton lots, per lb., 1s 10½d; 5-ton lots, per lb., 1s 10d. Tech., 1-ton lots in 1-cwt. drums, per cwt., £9 18s; 5-cwt. in 1-cwt. drums, per cwt., £10; 1-cwt. lots, £10 9s.

Salammoniac. Ton lot, in non-ret. pack, £47 10s.

Salicylic Acid. MANCHESTER: Tech., d/d, per lb., 2s 6d, cwt. lots.

Soda Ash. 58% ex-depot or d/d, London station, 1-ton lots, about £16 11s 6d.

Soda, Caustic. Solid 76/77%; spot, d/d 1-ton lots, £33 16s 6d.

Sodium Acetate. Comm. crystals, d/d, £75 8s

Sodium Bicarbonate. Ton lot, in non-ret. pack, £12 10s.

Sodium Bisulphite. Powder, 60/62%, d/d 2-ton lots for home trade, £46 2s 6d.

Sodium Carbonate Monohydrate. Ton lot, in non-ret. pack, c.p., £64.

Sodium Chlorate. 1-cwt. drums, c.p. station, in 4-ton lots, about £88 10s.

Sodium Cyanide. 96/98%, ton lot in 1-cwt. drums, £126.

Sodium Dichromate. Gran. Crystals per lb., 1s. Net d/d UK, anhydrous, per lb., 1s 1¾d. Net del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride. D/d, 1-ton lots and over, per cwt., £5; 1-cwt. lots, per cwt., £5 10s.

Sodium Hyposulphite. Pea crystals, £38; comm., 1-ton lots, c.p., £34 15s.

Sodium Iodide. BP, under 56 lb. per lb., 10s; 56 lb. and over, 9s 9d.

Sodium Metaphosphate [Calgon]. Flaked, paper sacks, £133.

Sodium Metasilicate. (Spot prices) D/d UK in 1-ton lots, 1-cwt. free paper bags, £29.

Sodium Nitrate. Chilean refined gran. over 98%, 6-ton lots, d/d c.p., per ton, £29.

Sodium Nitrite. 4-ton lots, £32.

Sodium Perborate. (10% available oxygen) in 1-cwt. free kegs, 1-ton lots, £129 10s; in 1-cwt. lots, £139 5s.

Sodium Percarbonate. 12½% available oxygen, in 1-cwt. kegs, £170 15s.

Sodium Phosphate. D/d, ton lots: di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate. (Spot prices) 75-84° Tw. Lancs and Ches., 6-ton lots, d/d station in loaned drums, £12 10s; Dorset, Somerset and Devon, per ton extra, £3 5s; Scotland and S. Wales, extra, £2 17s 6d. Elsewhere in England, not Cornwall, extra, £1.

Sodium Sulphate [Desiccated Glauber's Salt]. D/d in bags, about £19.

Sodium Sulphate [Glauber's Salt]. D/d, up to £14.

Sodium Sulphate [Salt Cake]. Unground, d/d station in bulk, £10. MANCHESTER: d/d station, £10 10s.

Sodium Sulphide. Solid, 60/62%, spot, d/d, in drums in 1-ton lots, £36 2s 6d; broken, d/d, in drums in 1-ton lots, £37 2s 6d.

Sodium Sulphite. Anhydrous, £71 10s; comm., d/d station in bags, £27-£28 10s.

Sulphur. 4 tons or more, ground, according to fineness, £20-£22.

Sulphuric Acid. Net, naked at works, 168° Tw. according to quality, £10-£11 12s 6d; 140° Tw., arsenic free, £8 7s 6d; 140° Tw., arsenious, £8 2s 6d.

Tartaric Acid. Per cwt.: 10 cwt. or more, in kegs, 300s; in bags, 292s per cwt.

Titanium Oxide. Standard grade comm., rutile structure, £178; standard grade comm., anatase structure, £163.

Zinc Oxide. Per ton: white seal, £112 10s; green seal, £110 10s; red seal, £107 10s.

SOLVENTS AND PLASTICISERS

Acetone. All d/d. In 5-gal. drums, £128; in 10-gal. drums, £118; in 40-45 gal. drums, under 1 ton, £93; 1-5 tons, £90; 5-10 tons, £89; 10 tons and up, £88; in 400-gal. tank wagons, £85.

Butyl Acetate BSS. 10-ton lots, £160.

***n*-Butyl Alcohol BSS.** 10 tons, in drums, d/d, £149.

***sec*-Butyl Alcohol.** All d/d. In 5-gal. drums, £168; in 10-gal. drums, £158; in 40-45 gal. drums, under 1 ton, £133; 1-5 tons,

£130; 5-10 tons, £129; 10 tons and up, £128; in 400-gal. tank wagons, £125.

***tert*-Butyl Alcohol.** 5-gal. drums, £195 10s; 40/45-gal. drums: 1 ton, £175 10s; 1-5 tons, £174 10s; 5-10 tons, £173 10s; 10 tons and up, £172 10s.

Diacetone Alcohol. Small lots: 5-gal. drums, £185; 10-gal. drums, £175. 40/45-gal. drums: under 1 ton, £148; 1-5 tons, £147; 5-10 tons, £146; 10 tons and over, £145, in 400-gal. tank wagons, £142.

Dibutyl Phthalate. In drums, 10 tons, d/d per ton, £210; 45-gal. drums, d/d, 1-4 drums, £216.

Diethyl Phthalate. In drums, 10 tons, per ton, £187 10s; 45-gal. drums, d/d, 1-4 drums, £193 10s.

Dimethyl Phthalate. In drums, 10 tons, per ton, d/d, £179; 45-gal. drums, d/d, 1-4 drums, £185.

Dioctyl Phthalate. In drums, 10 tons, d/d, per ton, £284; 45-gal. drums, d/d, 1-4 drums, £290.

Ether BSS. 1-ton lots, drums extra, per lb., 1s 11d.

Ethyl Acetate. 10-ton lots, d/d, £132.

Ethyl Alcohol [PB 66 o.p.]. Over 300,000 p. gal., 4s 0½d; d/d in tankers, 2,500-10,000 p. gal. per p. gal., 4s. 2¾d. D/d in 40/45-gal. drums, p.p.g. extra, 1d. Absolute alcohol (75.2 o.p.), p.p.g. extra, 5d.

Methanol. Pure synthetic, d/d, £43 15s.

Methylated Spirit. Industrial 66° o.p.: 500-gal. and up, d/d in tankers, per gal., 5s 10½d; 100-499 gal. in drums, d/d per gal., 6s 3d-6s 5d. Pyridinised 66° o.p.: 500 gal. and up, in tankers, d/d, per gal., 6s 2d; 100-499 gal. in drums, d/d, per gal., 6s 6½d-6s 8½d.

Methyl Ethyl Ketone. All d/d. In 5-gal. drums, £183; in 10-gal. drums, £173; in 40/45-gal. drums, under 1 ton, £148; 1-5 tons, £145; 5-10 tons, £144; 10 tons and up, £143; in 400-gal. tank wagons, £140.

Methyl *iso*Butyl Carbinol. All d/d. In 5-gal. drums, £203; in 10-gal. drums, £193; 40-45 gal. drums, less than 1 ton, £168; 1-9 tons, £165; 10 tons and over, £163; in 400-gal. tank wagons, £160.

Methyl *iso*Butyl Ketone. All d/d. In 5-gal. drums, £209; in 10-gal. drums, £199; in 40/45-gal. drums, under 1 ton, £174; 1-5 tons, £171; 5-10 tons, £170; 10 tons and up, £169; in 400-gal. tank wagons, £166.

***iso*Propyl Acetate.** In drums, 10 tons, d/d, £127; 45-gal. drums, d/d, £143.

***iso*Propyl Alcohol.** Small lots: 5-gal. drums, £118; 10-gal. drums, £108; 40/45-gal. drums: less than 1 ton, £83; 1-9 tons, £81; 10-50 tons, £80 10s; 50 tons and up, £80.

RUBBER CHEMICALS

Carbon Disulphide. According to quality, £61-£67.

Carbon Black. GPF: Ex-store, Swansea. Min. 3-ton lots, one delivery, 7¼d per lb.; min. 1-ton lots and up to 3-tons, one delivery, 7¾d per lb.; ex-store, Manchester, London and Glasgow, 8¼d per lb. HAF: ex-store, Swansea; Min. 3-ton lots, one delivery, 8d per lb.; min. 1-ton lots and up to 3-tons, one delivery, 8½d per lb. Ex-store Manchester, London and Glasgow, 9d per lb.

Carbon Tetrachloride. Ton lots, £83 15s.

India-Rubber Substitutes. White, per lb., 1s 4½d to 1s 7d; dark, d/d, per lb., 1s 0½d to 1s 4d.

Lithopone. 30%, about £55 10s for 5-ton lots.

Mineral Black. £7 10s-£10.

Sulphur Chloride. British, about £50.

Vegetable Lamp Black. 2-ton lots, £64 8s.

Vermilion. Pale or deep, 7-lb. lots, per lb., 15s 6d.

COAL TAR PRODUCTS

Benzole. Per gal., min. 200 gal., d/d in bulk, 90's, 5s 3d; pure, 5s 7d.

Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 4d; 40/50-gal. ret. drums extra, per lb., ½d. Crude, 60's, per gal., 8s 4d.
MANCHESTER: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s 5d.

Creosote. Home trade, per gal., according to quality, f.o.r. maker's works, 1s-1s 9d.
MANCHESTER: Per gal., 1s 2d-1s 8d.

Cresylic Acid. Pale 99/100%, per gal., 6s 8d. D/d UK in bulk: Pale ADF, per imperial gallon f.o.b. UK, 8s; per US gallon, c.i.f. NY, 103.50 cents freight equalised.

Naphtha. Solvent, 90/160°, per gal., 4s 10d; heavy, 90/190°, for bulk 1,000-gal. lots, d/d, per gal., 3s 11d. Drums extra; higher prices for smaller lots.

Naphthalene. Crude, 4-ton lots, in buyers' bags, nominal, according to m.p.: £19-£30; hot pressed, bulk, ex-works, £40; refined crystals, d/d min. 4-ton lots, £65-£68.

Pitch. Medium, soft, home trade, f.o.r. suppliers' works, £10 10s; export trade, f.o.b. suppliers' port, about £12.

Pyridine. 90/160, per gal., 15s.

Toluol. Pure, per gal., 5s 2d; 90's, d/d, 2,000 gal. in bulk, per gal., 4s 11d.
MANCHESTER: Pure, naked, per gal., 5s 6d.

Xyole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 5s 9d-6s.

INTERMEDIATES AND DYES
(Prices Normal)

***m*-Cresol** 98/100%. 10 cwt. lots d/d, per lb., 4s 9d.

***o*-Cresol** 30/31°C. D/d, per lb., 1s.

***p*-Cresol** 34/35°C. 10 cwt. lots d/d, per lb., 5s.

Dichloraniline. Per lb., 4s 6d.

Dinitrobenzene. 88/99°C., per lb., 2s 1d.

Dinitrotoluene. Drums extra. SP 15°C., per lb., 2s 1½d; SP 26°C., per lb., 1s 5d; SP 33°C., per lb., 1s 2½d; SP 66/68°C., per lb., 2s 1d.

***p*-Nitraniline.** Per lb., 5s 1d.

Nitrobenzene. Spot, 90 gal. drums (drums extra), 1-ton lots, d/d, per lb., 10d.

Nitroanphthalene. Per lb., 2s 5½d.

***o*-Toluidine.** 8-10 cwt. drums (drums extra), per lb., 1s 11d.

***p*-Toluidine.** In casks, per lb., 6s 1d.

Dimethylaniline. Drums extra, c.p., per lb., 3s 2d.

Metal Box Plastics Plant

Work starts shortly on a new plastics' factory at Speke, Liverpool, for the Metal Box Co. Ltd. The £325,000 contract has been awarded to Holland and Hannen and Cubitts (North West) Ltd. Due for completion in the autumn of 1960, the single-storey factory will measure 270 ft. by 250 ft. A two-storey office block adjoins the plant.

Courtaulds to Re-open Aber Works

Courtaulds Ltd. will soon re-open part of Aber Works, Flint, for the manufacture of bleached sulphate pulp for the paper and board industries, and plans are in hand for installation of machinery and plant for an initial output of some 50,000 tons per year. Production is scheduled to start towards the end of 1960.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sales Branch), 25 Southampton Buildings, Chancery Lane, London W.C.2, price 3s 6d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 13 January

Electrolytic reduction cells for the production of aluminium. British Aluminium Co. Ltd. **826 634 & 826 635**

Production of high molecular weight polyethylenes. Ziegler, K. **826 638**

Resinous materials and process for preparing same. Pittsburgh Plate Glass Co. **826 652**

Production of aminodiboranes. Callery Chemical Co. **826 557**

Preparation of cation exchange resins. Rohm & Haas Co. **826 658**

Polymerisable organic sulphides and polymers thereof. Rohm & Haas Co. **826 659**

Production of stable dimethylamineborine. Callery Chemical Co. **826 558**

Method for producing polyurethane plastics. Farberfabriken Bayer AG. **826 622**

Production of fluorine, bromine and iodine substituted organic compounds. Metal & Thermit Corp. **826 69**

Polymerisation process. Koppers Co. Inc. **826 561, 826 562 & 826 563**

Pyridazone compounds and process for their manufacture. Ciba Ltd. **826 640**

Methods of producing silicon of high purity. Standard Telephones & Cables Ltd. [Addition to 745 698.] **826 575**

Purification of hydrocarbons. D-X Sunray Oil Co. **826 656**

Aryl magnesium chloride complexes. Metal & Thermit Corp. [Addition to 776 993.] **826 620**

Steroids and the manufacture thereof. Upjohn Co. **826 629**

Concretes. Monsanto Chemicals Ltd. **826 582**

Conducting hydrocarbon conversions in nuclear reactors and apparatus therefor. Esso Research & Engineering Co. **826 583**

Protection of metal surfaces. Forestal Land, Timber & Railways Co. Ltd. [Divided out of 826 564.] **826 565 & 826 566**

Method and apparatus for producing films and flakes of glass. Owens-Corning Fiberglas Corp. **826 585**

Production of conjugated diolefins. British Hydrocarbon Chemicals Ltd. [Cognate application 21 878; and Cognate application 11 305/58.] [Divided out of 826 545.] **826 545 & 826 546**

Separation of Grignard reagents from cyclic ethers. Metal & Thermit Corp. **826 621**

Neutronic reaction fuels. General Electric Co. [Addition to 796 989.] **826 529**

Compositions for treating nematodes. Spencer Chemical Co. **826 532**

Naphthoquinone derivatives. Farbenfabriken Bayer AG. **826 533**

Apparatus for determining dust content of flowing gases. Bosch GmbH., R. **826 588**

Compositions containing polyepoxide and polyaminodiphenyl sulphones. Bataafsche Petroleum Maatschappij NV., De. **826 534**

Inhibitor compositions for protecting metals against corrosive liquids. Amchem Products Inc. **826 536**

Methods and apparatus for preventing breakage of a ribbon of glass, due to presence of a stone, during a drawing operation. Pilkington Bros. Ltd. **826 537**

Hypoglycaemic sulphonamide derivatives. Astra Apotekarnes Kemiska Fabriker AB. **826 539**

Thermoplastic compositions. United States Rubber Co. **826 540**

Resinous compositions. Pittsburgh Plate Glass Co. [Divided out of 826 652.] **826 653**

Apparatus for spreading pulverised or granular fertilisers. Landbouwwerktuigen-En Machinefabriek H. Vissers NV. **826 593**

Regeneration of absorbent material. D-X Sunray Oil Co. [Divided out of 826 656.] **826 657**

Apparatus for thoroughly mixing the components of a synthetic resin. Farbenfabriken Bayer AG. [Divided out of 826 622.] **826,623**

Vaporisation of hydrocarbons. Metallgesellschaft AG. **826 607**

High temperature separation of straight chain hydrocarbons. Socony Mobil Oil Co. Inc. **826 608**

1 - Phenyl - 3 - halogeno - 5 - p.perazinopyridazine-(6) compounds, and a process for their manufacture. Ciba Ltd. [Divided out of 826 440.] **826 641**

Steroids and the manufacture thereof. Upjohn Co. [Divided out of 826 629.] **826 630**

Catalysts for the polymerisation of ethylene. Ziegler, K. [Divided out of 826 638.] **826 639**

Epikote/Polyamide Paint System for New Orient Line Ship

Among materials used in the building of the Orient Line's new 40,000-ton liner *Oriana*, the largest passenger ship to be built in Britain since the *Queen Elizabeth*, one of the most interesting is the paint system that is used throughout the vessel. The hull has been coated with an epoxy resin/polyamide paint system supplied by Hangers Paints Ltd., Hull, which is based on Shell Chemical's Epikote resin. One coat of an etch-primer was followed by three coats of the paint which is one of the toughest and most corrosion-resistant coatings known. The superstructure and all inside and external surfaces will be similarly coated.

TRADE NOTES

John Thompson Ltd.

John Thompson Ltd., Ettingshall, Wolverhampton, are to open a branch office in Buenos Aires, capital of Argentina. The branch will be managed by Mr. R. J. Horlock, from the firm's export department in Wolverhampton.

Changes of Title (A.E.I.)

Reorganisation of Associated Electrical Industries Ltd. into several product divisions will be reflected in change of name of Birlec Ltd. to A.E.I.-Birlec Ltd., and in combination of Sunvic Controls Ltd. with Metrovic's scientific apparatus and X-ray departments. The latter will be titled the Instrumentation Division of Associated Electrical Industries Ltd. Both changes take effect from 1 January.

A. D. Wood Catalogue

The increased range of scientific glassware, etc., manufactured by A. D. Wood is described in the firm's new catalogue. It includes Quickfit and Quartz apparatus; Edwards High Vacuum equipment; apiezon oils, greases and waxes; graduated glassware; laboratory scaffolding; laboratory appliances; rubber ware; plastics ware; and capillary glass spirals for G.L.C. In addition, the well-known range of high vacuum glass stopcocks is listed.

Crane Packing Ltd.

The Crane condenser process is described and illustrated in a new 12-page booklet, copies of which can be obtained from Crane Packing Ltd., of Slough, Bucks, a member of the Tube Investment Group of companies.

Change of Name

Wadimex (Great Britain) Ltd., 27 Mitcham Park, Mitcham, Surrey, have changed their name to Mitcham Chemicals Ltd.

Acetate Ester Solvents

Distillers Co. Ltd., chemical division, Devonshire House, Mayfair Place, London W.1, announce reductions in prices of their acetate ester solvents. For 10-ton spot lots delivered in road tankers: ethyl acetate is reduced by £8 to £132; isopropyl acetate, by £5 to £127; and butyl acetate, by £8 to £160.

Instant Distilled Water

Portable and self-contained deioniser known as Top-it-Up for instant provision of distilled water of quality suitable for sterilisers is being marketed by Deionisation (Elga) Ltd., Lane End, Bucks. Designed specially for hospitals, surgeries and first aid posts, price is £28.

Butanox Catalyst

Butanox, comprising technical methyl ethyl ketone peroxide dissolved in phthalate plasticiser, is the subject of a new leaflet available from the Lucidol Products Division of Novadel Ltd., St. Ann's Crescent, London S.W.18. It includes data on decomposition, stability, explosibility, storage, toxicity, application, procedure and graphs indicating the behaviour of two general purpose polyester resins when cured with various quantities of Butanox and cobalt accelerator.

Solvay Caustic Soda Booklet

From Solvey et Cie, 33 Rue Prince Albert, Brussels, 5, a 62-page booklet in French entitled 'Soude Caustic' is available. Production techniques, properties, uses and analytical methods are included.

M. A. Phillips and Associates

Dr. M. A. Phillips and Associates, consultant division of M. A. Phillips and Associates Ltd., announce that Miyako Kagaku Co. Ltd., of 3-Chome, Marunouchi, Chiyodo-ku, Tokyo, have been appointed their sole agents and representatives for Japan and that M. A. Phillips and Associates Ltd., have been appointed sole agents in Europe (excepting the Soviet Union and their associated countries) for Miyako Kagaku Co. Ltd.

Fire Prevention System

A water-curtain fire prevention system which in certain cases can be used as a substitute for a fireproof wall is described in a new leaflet issued by Ascog Ltd., 44 Theobalds Road, London, W.C.1.

British Boilers in Canada

British Boiler Accessories Ltd., 62/3 Fenchurch Street, London, E.C.3, have recently entered into an arrangement with the Toronto Iron Works Ltd., of Canada, for the sale of B.B.A. steam accumulators and helical coil heat exchangers in Canada.

Change of Address

South-West and South Wales branch office of Elliott Brothers (London) Ltd., a member of the Elliott-Automation Group, has been moved to 55 Westgate Chambers, Newport, Mon. (tel. Newport 65710).

Contract Electric Smelting

The pilot plant being commissioned at Aldridge by Birlefco—Birlec-Efco (Melting) Ltd.—is claimed to be the only one in Britain to operate a contract service for electric smelting. The plant is intended to test the amenability of customers' raw materials to electrothermal reduction, and to determine the most suitable smelting technique and the nature of the products obtained.

I.C.I. Expansion Reduces Silicon Prices

Extensions to its silicon plant on Merseyside will enable the General Chemicals Division of the I.C.I. to raise capacity to 4,000 lb. a year, and it is reported that the benefit of the increased production will be passed to the consumer by way of price reductions.

First in the U.K. to make on a commercial scale the grades of silicon required for semiconductor devices, the plant was brought into operation early this year. Output of the plant is said to be adequate for all home demands, and considerable quantities are being exported. Plans for further extensions are already under way, designed to double capacity during 1960.

Demineralisation Plant for C.E.G.B.

William Boby and Co. Ltd., water treatment engineers of Rickmansworth (Herts), have been awarded the contract to supply complete demineralisation plant for C.E.G.B.'s power station at Earley, Reading.

DIARY DATES

MONDAY 30 NOVEMBER

Inst. Metal Finishing—London: Canterbury Room, Charing Cross Hotel, W.C.2, 2.45 p.m. Presidential address, 'The role of the scientific society'.

R.S.—London: Burlington House, W.1, 2.30 p.m. Anniversary meeting.

S.C.I.—London: Shell Mezzanie Theatre, Shell Mex House, Strand, W.C.2, 6.30 p.m. Scientific film evening.

TUESDAY 1 DECEMBER

Plastics Inst.—London: Wellcome Building, Euston Road, N.W.1, 6.30 p.m. 'Plastics and the law', by M. R. E. Ashenden.

WEDNESDAY 2 DECEMBER

Assoc. Printing Technologists—London: 11 Bedford Row, W.C.1, 7 p.m. 'A comparative study of sensitising salts for graphic reproduction processes', by H. L. Howard and G. C. Wensley.

Inst. Physics—Durham: Science Labs., University, 5.30 p.m. 'British national hydrogen bubble chamber project', by Prof. C. C. Butler.

THURSDAY 3 DECEMBER

Instn. Plant Eng.—London: Royal Inst., 21 Albemarle Street, W.1, 7 p.m. 'An introduction to electronic data processing', by Dr. H. A. Thomas.

Polarographic Soc.—Woking: 55 Oriental Road, 7.30 p.m. Problems in anodic polarography', by J. Hetman.

S.C.I.—London: 14 Belgrave Square, S.W.1, 6.15 p.m. 'Infective ribonucleic acid from the virus of foot-and-mouth disease', by Dr. F. Brown.

S.C.I.—Bristol: University of Bristol Chemical Dept., Woodland Road, 6 p.m. 'Beryllium metal; production, properties and applications', by Dr. G. A. Wolstenholme.

FRIDAY 4 DECEMBER

Inst. Physics—London: Royal Soc. of Tropical Medicine and Hygiene, 26 Portland Place, W.1, 2.15 p.m. Group annual meeting and lecture on 'Time-resolved spectroscopy', by Dr. H. Kaiser.

S.C.I.—Manchester: Main Chemistry Lecture Theatre, University, 6.30 p.m. 'Solubilisation with amphilic compounds', by Dr. P. A. Winsor.

SATURDAY 5 DECEMBER

S.A.C.—Liverpool: City Laboratories, Mount Pleasant, 2.15 p.m. 'Analysis of cocoa and chocolate in relation to modern manufacturing methods', by B. W. E. Minifie and C. Harris.

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KING'S PATENT AGENCY, LTD. (B. T. King, A.I.Mech.E., Patent Agent), 146a Queen Victoria Street, London, E.C.4. City 6161. Booklet on request.

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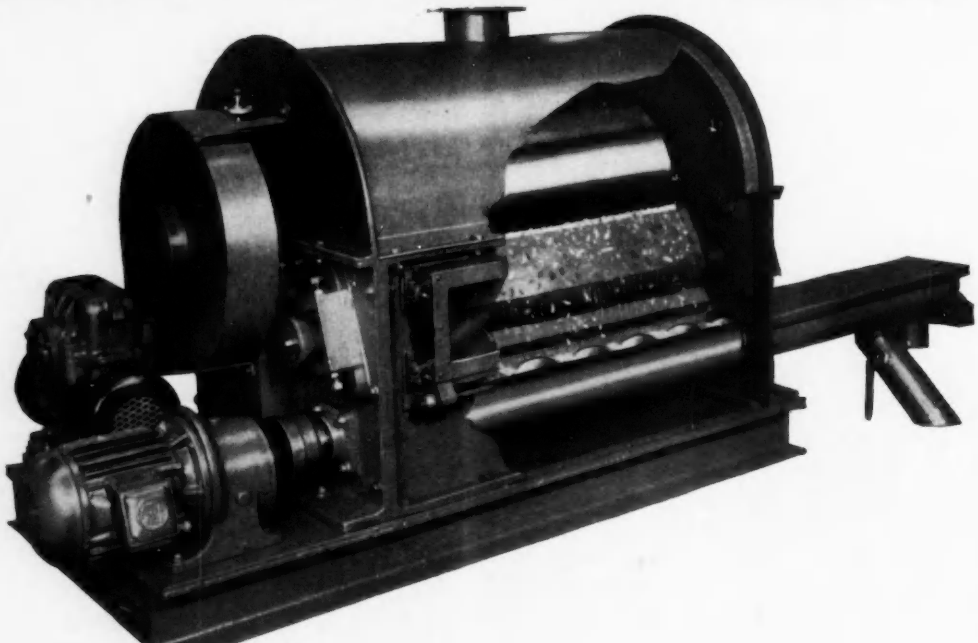

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